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APR 2 2 1947

Heating Piping & Air Conditioning

INDUSTRIAL
COMMERCIAL
INSTITUTIONAL AND
PUBLIC BUILDINGS

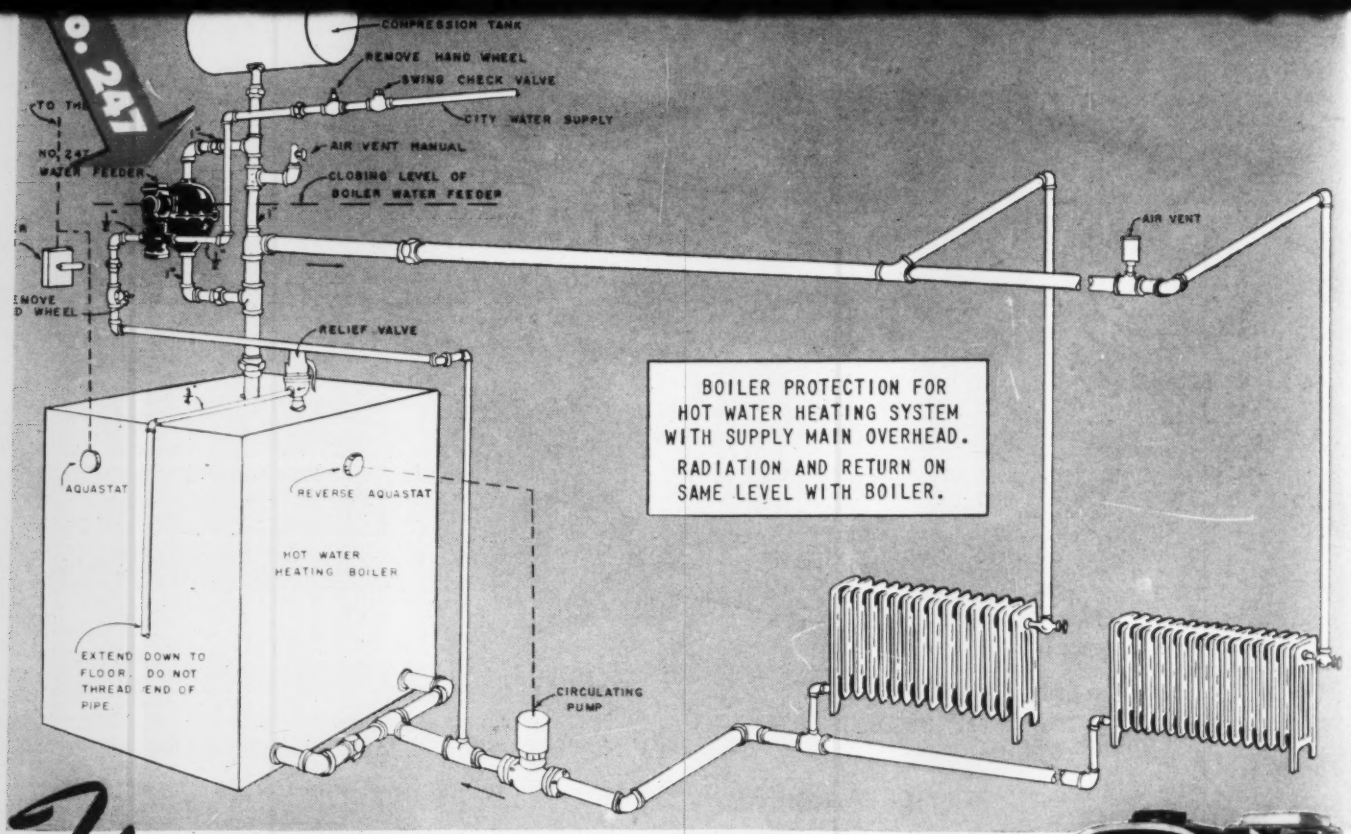
APRIL ★ 1947

DESIGN
INSTALLATION
OPERATION
MAINTENANCE

Page 103 — Journal Section of the American Society of Heating and Ventilating Engineers

Corners, ledges, and other dust collecting spots have been eliminated in this new air conditioned building—see page 67

CONTENTS . . PAGE 67


NO. 247
COMPRESSION TANK
REMOVE HAND WHEEL
SWING CHECK VALVE
CITY WATER SUPPLY
AIR VENT MANUAL
CLOSING LEVEL OF BOILER WATER FEEDER
AIR VENT
RELIEF VALVE
BOILER PROTECTION FOR HOT WATER HEATING SYSTEM WITH SUPPLY MAIN OVERHEAD. RADIATION AND RETURN ON SAME LEVEL WITH BOILER.
AQUASTAT
REVERSE AQUASTAT
HOT WATER HEATING BOILER
EXTEND DOWN TO FLOOR. DO NOT THREAD END OF PIPE
CIRCULATING PUMP

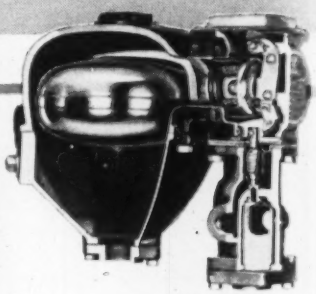
Yes, boiler water feeders on hot water heating systems!

• Some old timers may shrug their shoulders a little at the sight of water feeders on hot water heating boilers. The fact remains, however, that there will be more and more of them. They are being written into many hot water specifications; recommended for certain types of hot water systems by leading consulting engineers.

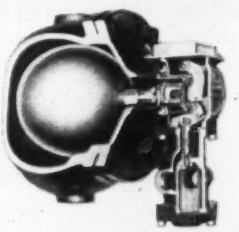
A typical application of a float operated boiler water feeder on a hot water system now being widely used is shown in the schematic drawing above—a forced circulation system with radiation on the same level as the boiler. We first ran into this need for a float operated boiler water feeder while studying the application of our Btu. rated safety relief valves. In army camps and housing projects where this and similar systems were used during the war, it was found that merely holding down pressure by means of an adequate relief valve could not, under certain conditions, prevent damage and boiler losses.

As a result, we were granted permission to conduct a series of experiments on systems of this type at Camp Carson, Colorado. In the course of this work it was found that the trouble could be corrected by installing a float operated boiler water feeder as shown in the drawing to keep the system filled to its highest point. And so conclusive were the results that the hook-up became standard under "Corps of Engineers Specification CE-51 Forced Hot Water Heating Systems," for systems of this kind. Many float operated feeders have since been installed on these "same-level" systems and *there is no case on record of any trouble with plants so equipped.*

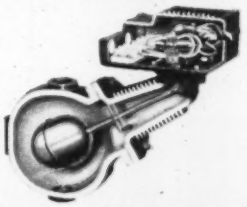
In applying float operated boiler water feeders to hot water systems it has also been found that in addition to the protection of the boiler, a number of gains are made in the efficiency and dependability of operation of the system. The story is too involved to be told in limited space, but many eye-opening and helpful facts are available to those interested in this rapidly broadening field.



McDonnell No. 247 boiler water feeder used on type of hot water system shown above. It is the same as the McDonnell No. 47 except that it is for installation with equalizing piping. It is also available with low water cut-off switch (as No. 247-2) for automatically fired hot water boilers.



McDonnell No. 51 boiler water feeder for the larger boilers. This type of feeder is also available with low water cut-off switch (as No. 51-2) for automatically fired hot water boilers.



No. 150 low water control for boilers of any size with pressures up to 150 lbs. The No. 150 may be used as low water cut-off; low water alarm, or as a combination of these functions.

McDONNELL & MILLER, INC., 1316 Wrigley Bldg., Chicago 11, Ill.

Your Jobber Stocks Them

Doing One Thing Well

McDONNELL *Boiler Water Level* CONTROLS

The Editor's Pages

PIPING MEN WIN DOW AWARDS

Robert F. Elliott's prompt and intelligent action in meeting an emergency threatening steam distribution lines brought about by a heavy rainstorm, and Arthur Gould's design and development of a new method for checking accuracy in the installation of high temperature steam pipes in power plants, numbered them among the first five winners of the Alex Dow award, established by the Detroit Edison Co. last year to perpetuate the memory of its long-time president and to recognize outstanding accomplishments by employees.

Mr. Elliott was selected as a winner because of his action in an emergency occasioned by a heavy rainstorm on May 31. During the downpour, a portion of steam distribution system was flooded, setting up serious water hammer. Mr. Elliott's prompt action, initiative, and judgment were responsible for the rapid restoration of service to customers and prevented serious damage to property.

Mr. Gould designed and developed a method for checking accuracy of erection in installing high temperature steam pipes. This was accomplished by planning the erection of the line in sections. The position of the line is checked by means of reference points before making the joints between the sections. By application of this method, the finished structure conforms with the design as to location of the line, dimensions, pitch, and cold spring.

ASSOCIATIONS ELECT NEW OFFICERS

Five manufacturers' associations announced their new officers last month, following annual meetings of the groups.

President of the National Association of Fan Manufacturers, 5-208 General Motors Bldg., Detroit 2, is T. J. Flanagan, Garden City Fan Co. The vice president is G. C. Derry, B. F. Sturtevant Co., Div. of Westinghouse Electric, and the secretary-treasurer is L. O. Monroe.

Mr. Monroe is also secretary-treasurer of the Industrial Unit Heater Association, and the Propeller Fan Manufacturers' Association, both of the same address. The IUHA's president is R. H. Nelson, Herman Nelson Corp., and the vice president is R. J. Resch, McQuay, Inc. W. J. Lohman, Jr., Chelsea Products, Inc., heads the PFMA, with M. L. Aitken, Propellair, Inc., as vice president.

H. Berkley Hedges, John J. Nesbitt, Inc., is president of the Blast Coil Manufacturers' Institute, H. F. Brinen, Young Radiator Co., is vice president, and Wm. P. Raffone, G & O Mfg. Co., New Haven 8, Conn., is secretary-treasurer.

Charles G. Andrew, Air Reduction Co., Inc., was elected president of the Compressed Gas Manufacturers' Association. Other officers are L. W. Hench, American Oxygen Service Co., first vice president; Edmund Rowland, Henry Bower Chemical Mfg. Co., second vice president, and F. R. Featherston, secretary-treasurer.

PROPOSES PROHIBITING RETURN AIR IN CORRIDORS

A fire protection regulation prohibiting the use of corridors in hotels, hospitals, institutions, and similar occupancies, and in multi-family apartment buildings, as part of the ventilating or air conditioning systems has been proposed, according to J. T. W. Babcock, assistant chief engineer, Factory Insurance Association, in a recent talk on trends in safety control in ventilating systems given before the Illinois chapter of the American Society of Heating and Ventilating Engineers. This would make it impossible to use the corridors for return air passages.

Mr. Babcock said that another proposed regulation would permit an air conditioning or ventilating system to be designed for removal of smoke, in cases where this was advisable. Means would apparently be provided to shut down the supply but keep the exhaust on in case of fire. Considerable opinion questioning the advisability of this idea was expressed at the meeting, particularly as to whether such a regulation would accomplish the intended purpose. The speaker said that he felt that maybe the fire department is the only authority who should decide when and how a building on fire should be ventilated.

Mr. Babcock stressed that both of these regulations were only proposals at present, and had not been adopted.

A. C. KIRKWOOD ANNOUNCES NEW ENGINEERING FIRM

Arthur C. Kirkwood, member of HPAC's board of consulting and contributing editors, has announced formation of A. C. Kirkwood & Associates. Wirthman Building, Kansas City 3, Mo. Services offered include reports, appraisals, rate studies, and consultation, fully complemented by engineering design services.

Mr. Kirkwood has had broad experience in the field of consulting engineering. For the past 17 years, he has been associated with the Burns & McDonnell Engineering Co. as associate and principal engineer, in responsible charge of a wide variety of engineering projects in many parts of the country from California to Massachusetts, and Florida and Louisiana to Michigan.

FOUNDER'S GREAT GRANDSON HEADS VALVE MANUFACTURER

Alfred J. Yardley has been elected president of Jenkins Bros., manufacturer of valves, succeeding his father, Farnham Yardley, who becomes chairman of the board. A great grandson of Nathaniel Jenkins, the founder, he is the fourth president in the 83 years of the company's existence.

James L. Dunn, vice president in charge of industrial relations, and C. C. Chamberlain, general sales manager, were elected to the board of directors.

The Editor's Pages

ASTM COMMITTEES REVISE SPECIFICATIONS

New test methods and tentative specifications, and numerous revisions in existing standards, were discussed at more than 250 meetings of technical committees of the American Society for Testing Materials during ASTM committee week beginning February 24 in Philadelphia. Most of the committee actions will be confirmed by letter ballot and referred to the ASTM at its annual meeting in June.

Steel Pipe and Tubing

For many years there has been intense activity in the subcommittee on steel pipe and tubing, headed by T. G. Stitt, Pittsburgh Steel Co., which group is responsible for some 40 widely used standards covering pipe, boiler and superheater tubes, tubing for refinery service, materials for heat exchanger and still tubes, etc. The pipe specifications A 53, A 120, and A 253 will have tables of specific test pressure for each size incorporated, and there will be supplementary data added covering threading and including sketches of joints, etc. Following recommendations from the dairy industry, the standard covering stainless tubing, A 270, will be modified with minor changes in the table of dimensional tolerances, the deletion of unpolished tubing, and as revised, this tentative and three others covering stainless tubing are to be recommended for adoption as standard, the other items covering ferritic stainless for general service (A 268), austenitic for general service (A 269), and austenitic for refinery service (A 271).

Five specifications have been available for a number of years covering various types of electric resistance welded tubing for use in boilers, heat exchangers, etc. After very intensive discussion based on considerable investigation, proposed revisions were published a year ago which provide for more rigorous testing procedures, and in general bring the requirements in line with latest practice. These are to be recommended for adoption as standard. One of the provisions will permit the use of nondestructive electric test instead of the hydrostatic test where there is mutual agreement.

In cooperation with the subcommittee concerned with valves, flanges and fittings, this subcommittee is continuing studies of requirements for pipe for low temperature applications.

High Temperature Service

The work of the committee on materials for valves, flanges, and fittings for high temperature service, headed by Dr. A. E. White, University of Michigan, covers pipe, castings, bolting and forgings. The existing tentative for heat treated carbon bolts, A 261, is to be adopted as standard. A study of testing requirements for nuts, as covered in A 194, indicated the provisions should be evaluated through further trial before changes are proposed. A specification for bolting for subatmospheric temperatures is being drafted. In the work on castings, where there are several specifications in wide usage, the one covering material suitable for fusion welding for high temperature service is to be adopted as standard, while a companion specification for alloy steel castings will be changed to include at least four new grades coming into rather extensive usage, as follows: chrome-nickel-molybdenum; chrome-molybdenum; 1 per cent molybdenum; and molybdenum-vanadium.

The possibility of consolidating this revised specification with the general older standard covering alloy steel material, A 157, is to be considered.

In work on pipe for high temperature service, reference to deoxidized acid-bessemer material will be deleted from the tentative A 106. Extensive changes involve the matter of surface defects with many details covered. In the new tentative issued last year for ½ per cent chromium—½ per cent molybdenum pipe, A 280, established to provide material which should inhibit graphitization, the present chromium range of "0.40-0.60" is to be changed to read "0.50-0.70." Under study is another chemical composition with still higher chromium, and a molybdenum-vanadium grade of pipe is also being investigated. A new standard to cover five austenitic grades of stainless steel pipe (as distinct from tubing) is being drafted.

Insulating Materials

Progress on a code for determining thermal conductivity, conductance and transmittance, preparation of a proposed test method for thermal conductivity of pipe insulation, and a series of studies inaugurated on research problems covering vapor barriers, were announced at the meeting of committee C-16 on thermal insulating materials. The largest attendance in the history of the committee was recorded as its members participated in 11 subcommittee and committee sessions covering a period of three days. A return to basic activity as prevalent before the war and a steadily increasing interest in the work of the committee was in evidence.

G. E. OTIS RETIRES

Gerald Earle Otis, vice president of the Herman Nelson Corp., retired March 31 in accordance with the provisions of the employees retirement plan established by the company several years ago. Nationally known as an authority on heating and ventilating of schools, he will continue as a director of the company.

During the war, Mr. Otis served in Washington as a consultant in the WPB's heating and plumbing division.

BEARING INDUSTRY OFFERS STANDARD NUMBERING

A standardized numbering system for ball and roller bearing dimensions was presented recently to the American Standards Association by the Anti-Friction Bearing Manufacturers Association.

The new code calls for a common means of identifying types, sizes, tolerances, modification of internal design, and lubrication of standard ball and roller bearings to meet all the requirements of users.

Celebrating a Centennial of Service

THE PENN MUTUAL LIFE INSURANCE COMPANY
Home Office, Philadelphia, Pa. 10-story building at right built 1914 20-story addition built 1933.

This is a year of celebration at Penn Mutual—their 100th year of satisfactory service to thousands of policyowners. It also represents the 40th year of satisfactory heating service by Webster Steam Heating Equipment in Penn Mutual buildings.

Webster Steam Heating Equipment was first used by Penn Mutual in their home office building at 10th and Chestnut streets in 1907.

In 1933 when the present home of Penn Mutual on Independence Square was completed with the building of a 20-story addition, the entire installation was equipped with a Webster Vacuum Heating System, including 990 Webster Radiator Traps. Edgar V. Seeler was the architect and Henry Adams was the consulting engineer for the 10-story building. Ernest J. Mathewson designed the 20-story addition, and the firm of Isaac Hathaway Francis, which later became Moody and Hutchison, served as consulting engineers.

In 1941, a careful study of the heating installation indicated the possibility of reducing oil consumption in line with the war-time fuel conservation program by installing a "Controlled-by-the-Weather" Webster Moderator System. The consulting engineer for the modernization was the firm of Eggly Engineers. W. E. Anderson Co., who made the original installation, also served as heating contractors for the modernization.

The building was divided into six heating zones. Automatic continuous "control-by-the-weather" was provided by a Webster Outdoor Thermostat and Webster Central Control. Radiator valves were equipped with expertly sized Webster Metering Orifices.

"Our records show a 10 per cent reduction in oil consumption with the Webster Moderator System," says LeRoy E. Varner, Company Engineer. "All sections of the building heat evenly and rapidly."

In the Penn Mutual Building, Webster Controls have operated with coal and oil with equally satisfactory results.

Much of the success of the Penn Mutual heating installation has resulted from the experience and competent operation of the building management. Richard Pape, who was Chief Engineer for Penn Mutual at the time of the original Webster installation in 1907, looked to Webster for heating equipment until his retirement. LeRoy E. Varner, who came to Penn Mutual in 1932, has used Webster Heating Equipment during the ensuing 15 years.

The continuity of Webster service has been provided by Karl Rugart, Philadelphia Representative, with Webster for 32 years.

Not only the materials but the skill and ability of trained, long-service representatives are available to help you obtain a heating program similar to the one in the Penn Mutual Building.

WARREN WEBSTER & CO., Camden, N. J.
Representatives in principal U. S. Cities : : Est. 1888
In Canada, Darling Brothers, Limited, Montreal

Webster
HEATING SYSTEMS

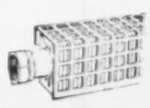
Webster Heating Equipment for Today's New Buildings

Webster Metering Orifices, expertly sized, a vital feature of the Moderator System, balance distribution and make possible central control with continuous heating.

Webster Outdoor Thermostat Control automatically provides the lowest pressure for comfortable inside temperature.

Webster Electronic Moderator Control Cabinet provides continuous heating, always under control.

Webster System Radiation—concealed convectors made of copper tubing and aluminum fins, with *integral* Webster Traps and Valves.



New! Webster Type WI Radiation for installation where floor or wall space is limited.

HOSPITAL—MONTGOMERY COUNTY, OHIO
RIAL THOMAS PARRISH, Arch. and Engr.
GANGER BROTHERS, Heating Contractors
H. S. SAUNDERS, Plumbing Contractor
Keeping this hospital piping healthy—
BYERS WROUGHT IRON PIPE

This converter room serves the Montgomery County Hospital, a one-story, 100-bed institution for the care of the aged. The health and comfort of the patients is safeguarded with radiant heating. The health of the piping, and the pocketbooks of the owners, are safeguarded by the use of wrought iron.

The installation pictured is 100% Byers Wrought Iron pipe. The material was used in all radiant heating piping, as well as in hot and cold water lines, and in the wastes and vents from kitchen and from sterilizers.

This widespread application of wrought iron continues a practice that careful designers have followed for years. Hospital income provides no cushion to take care of excessive repairs, so that the use of materials of proven durability is not only desirable, but essential. Records of installations in all sections of the country provide plenty of evidence that wrought iron can be expected to serve longer and cost less per year.

The reason for the excellent service qualities of wrought iron can be found in its structure and composition which are duplicated in no other material. Tiny fibers of glass-like silicate slag, threaded through the body of high-purity iron, halt and "detour" corrosive attack. This discourages the pitting and penetration that generally causes low-first-cost materials to fail prematurely. The fibers also help anchor the initial protective scale, which shields the underlying metal.

Our bulletin, "Wrought Iron for Piping Systems," illustrates and describes a number of typical installations, and gives helpful information. Ask for a complimentary copy.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, Salt Lake City, Seattle, San Francisco.

Corrosion costs you more than wrought iron

"ETERNALLY YOURS" —professionally-produced 16mm sound motion picture. An entertaining saga of the wrought iron industry, available to technical groups. New, authentic, informative. Write Modern Talking Picture Service, Inc., 9 Rockefeller Plaza, N. Y. 20, N. Y.

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ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

Heating Piping & Air Conditioning

with which is merged the Aerologist

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Telephone: Murray Hill 9-8293

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Publisher.....Frank P. Keeney

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CONTENTS THIS MONTH

Vol. 19 APRIL 1947 No. 4

The Editor's Pages (news, notes and comment)..... 63

Air Conditioning the New York Stock Exchange, by Donald A. Kepler..... 69

Space, Weight Govern Train and Bus Conditioning..... 73

Meets Increased Central Steam Demands With 4800 Ft Tie Line, by Julius J. Schenk and R. H. McCumber..... 74

Says Heat Pump Requires 1½c Rate to Compete on Cost..... 76

Unit Heaters, Finned Pipe Radiation for Standardized Factory Building..... 77

Foundry Ventilation, by Jim Black and Lester T. Avery..... 78

Says More Data Needed on Air Sterilization..... 81

Time Lag in Radiant Heating, by Warren E. Wilson..... 82

This Building Must Be Clean..... 87

Forecasts $100 Million Annual Market for Commercial, Industrial Air Conditioning..... 88

Design Engineer Reports on Operating Experience, by John H. Clarke..... 89

Sam Lewis' Page—Wrong Exhaust Opening Can Cause Ventilation Troubles..... 94

"Open for Discussion"—Radiant Cooling Must Be Designed Properly..... 96

Ice Rink Piping Fails During Wartime Shutdown, by Paul S. Park 97

Question of the Month..... 98

How to Stop Condensation on Confectionery Window..... 98

How to Heat Office Room in Steam Heated Garage..... 100

Data Sheet—Conductivities and Conductances of Building Materials and Insulations, by Paul D. Close..... 101

Equipment Developments..... 161

New Books & Reports..... 180

Meetings & Conventions..... 186

Recent Trade Literature..... 190

Index to Advertisers..... 200

Journal Section of the American Society of Heating and Ventilating Engineers

Proceedings of 53rd Annual Meeting, ASHVE..... 103

Panel Heating Conference Approves ASHVE as Coordinator..... 123

June Is Semi-Annual Meeting Time..... 124

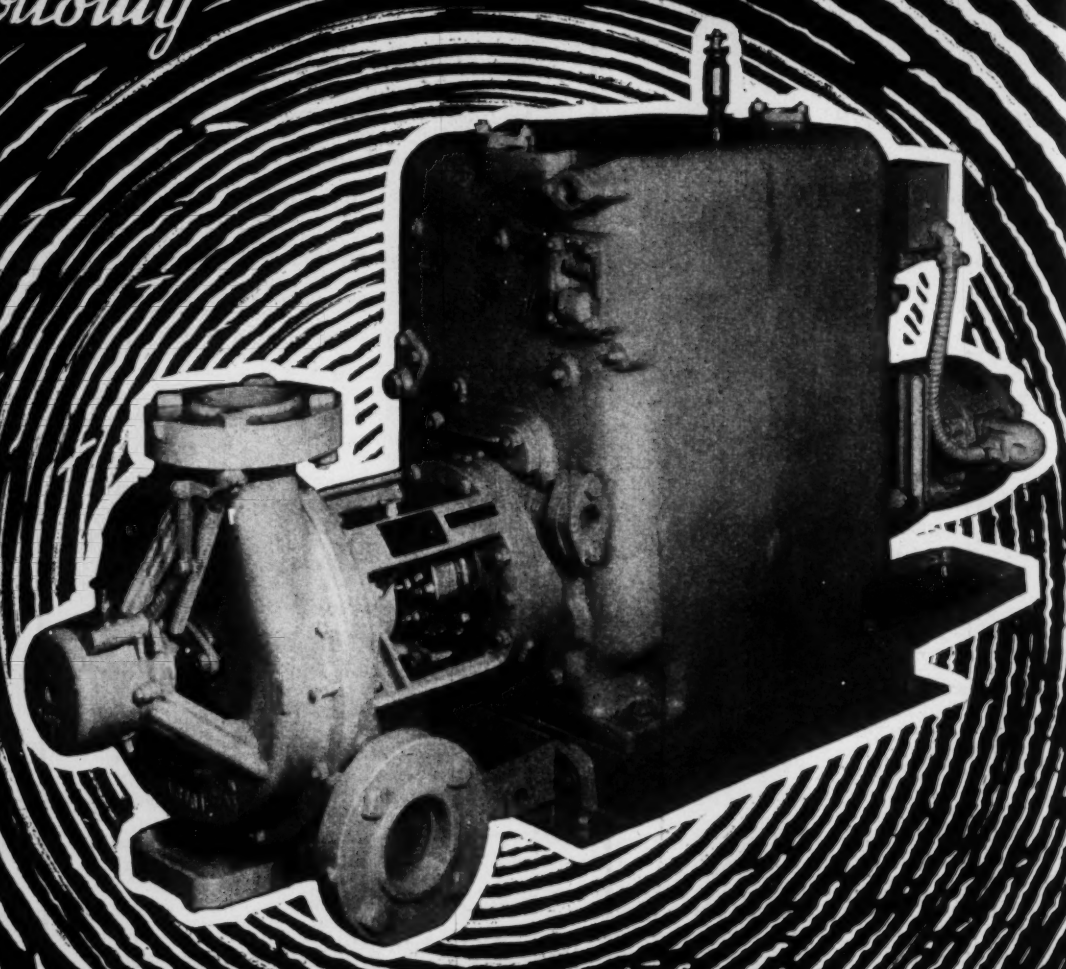
Summary of Local Chapter Meetings..... 128

Candidates for Membership..... 133

Candidates Elected..... 135

Officers, Council, and Committees..... 137

Centralized Heating Economy



A RETURN LINE VACUUM PUMP THAT CUTS HEATING COST.

This unusual pump needs no electric current, cutting out greatest item of pump operating expense.

More important, this pump insures absolutely uniform circulation in system. That means continuous steam economy.

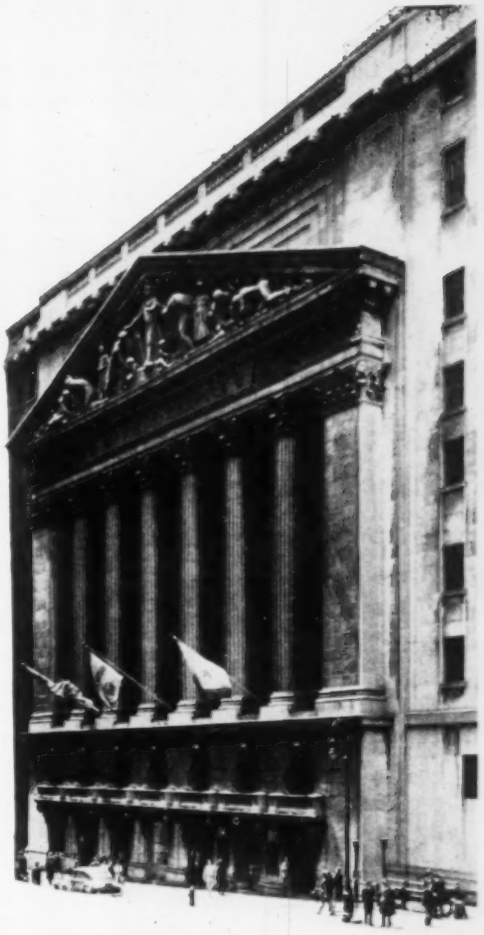
Simple, compact, one moving element, no wearing parts, no internal lubrication. Bulletin No. 203 gives the facts. Your copy is waiting.

THE NASH ENGINEERING COMPANY
SOUTH NORWALK, CONNECTICUT, U. S. A.

PARALLELS INDUSTRY'S PROGRESS

AIR CONDITIONING the New York Stock Exchange

By Donald A. Kepler
Chief Engineer
New York Stock Exchange Building Company



Described as "one of the architectural adornments of the City," and considered the masterpiece of Architect George B. Post, the New York Stock Exchange building was begun in 1901 and occupied in 1903. The trading area, or board room, is behind the huge pillars.

"IF THEY CAN cool dead hogs in Chicago, why not live 'bulls and bears' in the New York Stock Exchange?"* As stated in 1893, this prophetic remark was not intended as a specific recommendation to the "bulls and bears" of Wall Street; rather it was a commentary on the reticence of scientific people in putting their new discoveries to work. Only 10 years later, however, the Stock Exchange pioneered by accepting the idea literally, putting the new theories into practical form by installing one of the first air cooling systems of its kind. Professor Doremus, in advocating such a scheme, apparently was not too far ahead of the times.

The occasion for the professor's remark was his article praising the genius of Sir James Dewar, who several years before announced the results of his experiments on the liquefaction of gases. The use of liquefied gases to produce a refrigeration effect was what interested Professor Doremus. His observations went still further: "Citizens would be happier, merchants would make more money, and physicians would save more lives with the temperature at 70 deg than at 90 or 100 deg."

Parallels Advance of the Industry

The air conditioning history of the New York Stock Exchange has paralleled, in a large measure, the development of many significant advances in the heating and ventilating industry over the past 50 years.

In the chronology of the Stock Exchange's air conditioning experiences, there are three high spots representing its three major air conditioning projects. The first is the story of the original system, describing the introduction of comfort cooling to a large and densely populated market place. This was by far the largest refrigerating plant devoted primarily to air cooling and dehumidification. The second is the experience of replacing the original system, after nearly 20 years of service, with the one now in use; this phase reflects air conditioning's progress up to the time of World War I. The third is the planning of a new system which will include the best that modern air conditioning has to offer.

The three phases of the historical development of air conditioning as related to the New York Stock Exchange will be described in a series of three articles, of which this is the first.

New York was still a city without a skyline in 1900, when the Stock Exchange decided to launch a new building program. How the air cooling plant came to be included in this program is the story of two engineers and a committee.

Unlike most of the new buildings then in prospect, plans for the new Stock Exchange called for a comparatively low structure, squat and square. Emphasis was to center on the best ways and means of conducting the Stock Exchange's special kind of business. A certain elegance, of course, was to go along with this—an elegance befitting the dignity of the securities broker of the day—but this was secondary.

The board of governors had delegated to a building committee the responsibility of securing the best talent for planning and the most modern facilities for trading.

The building was to be eight stories above ground and four floors below. The large windows which cover most of the east, or Broad St., side were duplicated on the opposite side. Curtains which could be raised and lowered were furnished on the east windows to reduce the glare of direct sunlight. The board room is 110 ft by 140 ft with a ceiling height of 80 ft. A skylight in the center of the ceiling provided additional light through a light court above. In addition to all the natural sources of illumination, 62 arc lamps were distributed over the ceiling.

When the important question of

*Doremus, R. O., M.D., LL.D. Thoughts Suggested by Professor Dewar's Discoveries. North American Review, pp. 550-551, New York, N. Y., May 1893.

THREE HIGH SPOTS of the New York Stock Exchange's air conditioning experiences are its three major air conditioning projects. The first is the original system, the introduction of comfort cooling to a large and densely populated market place. The second is the replacement of the original system, after nearly 20 years of service, with the one now in use. And the third is the planning of a new system which will include "the best that modern air conditioning has to offer" . . . Mr. Kepler joined the New York Stock Exchange Building Co. as ventilating engineer in 1937, and in 1942 was assigned the duties of chief engineer and those of project engineer for mechanical plant and equipment

ventilation came before the building committee—and they were primarily interested in the board room ventilation—it was the considered opinion of all concerned that Alfred R. Wolff, an outstanding ventilating engineer of the day, should be engaged by the architect. Despite the fact that plans for the building were in the most elementary stages when Mr. Wolff first received them, he apparently foresaw the complexities of some of the structural features and he expressed dissatisfaction with the established custom that fixed the engineer's fee at some fraction of the architect's fee. Mr. Wolff argued that engineer's fees should be based on the amount of engineering involved. In what was probably the first such action of its kind, the committee acceded to his claim and he was retained on a separate fee basis!

Summer Ventilation the Problem

Two weeks were alloted by the architect for the completion of the ventilation drawings, but Mr. Wolff insisted that this was out of the question. Nine months later the plans were completed to the point where accurate cost estimates could be taken off. That is, all plans were ready but one. The all-important board room design did not satisfy Mr. Wolff, nor did he see any solution for the problem.

The trouble had to do with summer ventilation. The temperature in New York City seldom exceeded 90 deg, and on such occasions the humidity was invariably low. However, much of the weather consisted of temperatures of 80 to 85 deg with high humidities, from 80 to 90 per cent. In this sort of weather, even unusually large air quantities were never very effective, especially with the solar heat from the large windows and the inordinately heavy "animal heat" load. In the case of the board room, the assignment looked hopeless, for here over 1000 busy people were expected to mill about the trading posts in activity involving considerable physical exertion.

It was at this point that Henry Torrance entered the picture. They had worked together on jobs concerned with candy drying and setting. While Mr. Torrance was a refrigeration engineer, his wide experience put him on familiar ground when dealing with problems of air cooling and moisture extraction. This was precisely Mr. Wolff's difficulty, for, although almost nothing was known about the internal latent heat load in those days, it was recognized as a ventilation bugaboo. Together these two men sketched out a plan for artificially cooling the board room supply air. Mr. Wolff was elated with the possibilities and he was thoroughly convinced that only such a plan would produce the desired results. At one of their sessions, he commented "If I can get to the committee, I will certainly sell this thing." His opportunity came almost immediately for he was called before the committee to explain his tardiness, which was delaying some of the other contracts. He explained the exceptional intricacy of his problems and pointed out that "the great difficulty of working in the heating and ventilating plant is only equalled by the importance of having it right." He then proceeded to advance the cooled air idea. The job sold—for about $130,000 more than the original estimate.

For the description of the apparatus and the calculations for the refrigeration equipment which follows, and for helpful comments generally, the author is indebted to Henry Torrance, Jr., and his article Refrigeration and Ventilation of Inhabited Places.†

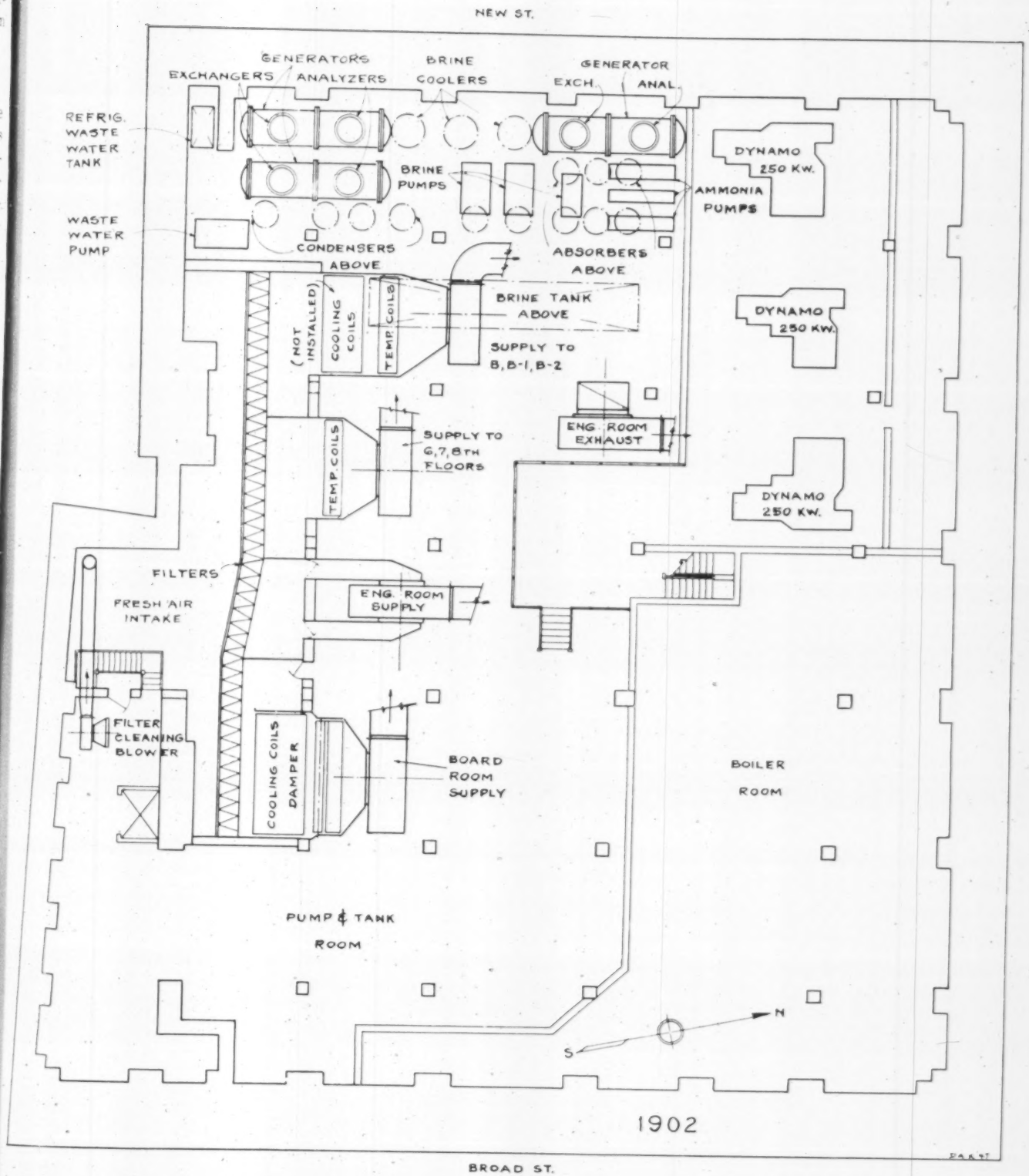
General Ventilation Scheme

Considering the date when the plans were conceived, the provisions for general ventilation show a remarkable thoroughness. The specifications called for "fresh air supply and exhaust for the entire building," a fan for the board room, one for the three basement floors, a third for the three floors above the board room, and a fourth for the engine room. An exhaust fan was provided for the basement floors and the engine room, while the exhaust from all spaces above the street level went to the large roof fan. Two spaces were provided with cool air, the board room and the vault (Basement 1 level). As was customary in that day, mechanical equipment was confined to the engine room or to spaces remote from occupied areas.

All the supply fans were arranged in a line contiguous to the base of the fresh air shaft, through which air was drawn from the roof about 200 ft above. The air first passed through cheesecloth filters, then through the cooling coils (where provided), then through the tempering coils (for winter use only), and on to the fan suction. Air moistening devices were used in conjunction with the tempering stacks; these consisted of pans of water heated by immersed steam pipes. Evaporated moisture was picked up by the air stream under control of a humidistat. Pneumatic thermostats and double dampers in the inlet controlled the fan discharge temperatures in the winter but no controls were employed in the cooling season.

The fan for the board room had, according to the terms of the specifications, a "blast wheel 11 ft 0 in. diameter by 5 ft 0 in. wide," rated to deliver 50,000 cfm at 110 rpm. This was driven by a 24 hp d-c direct connected motor. The large exhaust fan located in the fan house on the roof was a double-disc fan actually two fans on a single shaft, " . . . 8½ ft in diameter with motor capacity to drive the fans at a

†Torrance, Henry, IInd International Congress of Refrigeration, Vienna 1910. English Edition of the Reports and Proceedings, pp. 839-848. General-Commissariat, Vienna (1911).



The 1902 installation. The filter cleaning blower, indicated at the south side of the building, discharged its dust laden air to the atmosphere at the roof level of the adjoining building. The entire bank of cheesecloth filters was cleaned during the course of a week. With the dirty filters set in a rack at the blower suction, the filters were brushed lightly with a straw broom and the dirt was carried off by the blower suction. The vacuum cleaning procedure was very effective, but strict adherence to the weekly schedule was necessary. The waste water tank, shown in the southwest corner, served as a receiver for the water from the refrigeration condensers. The waste water pump delivered this water to a tank in the attic which held a supply to be used for flushing

maximum speed of 150 rpm." While this fan actually served as air exhaust from all spaces above the street level, its primary assignment was to serve the board room by removing the vitiated air through the ductwork under the board room floor.

Refrigeration Presented Problems

Since air cooling had been an afterthought, fitting in the heavy refrigeration equipment after other plans were well along presented some difficult problems. An ammonia absorption plant was selected since the large quantity of exhaust steam available in the summer could be used to advantage. Three 100 ton machines were set up west of the fan apparatus. In this area the floor arches above were omitted so that a ceiling height of 28 ft became available for hanging the heat exchange apparatus. Each machine required an ammonia pump. Two steam brine pumps operating together circulated 280 gpm from a brine tank of about 25,000 gal capacity located overhead.

In addition to the apparatus required for air cooling, a drinking water system for the building and a steam pump which circulated chilled brine to the 12 refrigerator boxes in the kitchen were included.

The original plan called for three 150 ton refrigeration machines to meet the cooling requirements of the board room plus the *three* basement floors. However, before construction work was begun, the plan was cut down to include only the board room and the vault. The vault supply was tapped into the board room system.

Air Cooling Unit for Board Room

Putting the refrigeration to work proved to be a relatively simple matter. The air cooling coils were made up of 20,000 ft of 1¼ in. pipe bent horizontally, spaced 3 in. on centers and set into headers. These coils, incidentally, were considered a part of the refrigerating plant and as such were included in the refrigeration contract. The heating coils, and all other equipment for the air unit, were covered in the ventilation contract. A copper drip pan with a drain connection disposed of the condensate.

Performance and Design of Plant

The brine temperatures employed would seem exceedingly low by today's standards. Brine entered at between 10 and 20 deg and left at about 40. Since the coils were in counterflow arrangement, the last half of the coil was frosted. With fresh air at 85 deg the fan discharge temperature was 60. However, by the time the air reached the board room ceiling, 160 ft above, its temperature was about 65 deg.

Under these conditions, the room was held between 75 and 77 deg, most of the time 10 deg lower than the outside temperature. In very humid weather, more of the available refrigeration output went to extracting moisture and with the same room temperature, say 77, comfortable conditions prevailed. Thus the engineers came to conclude that the spread between inside and outside temperatures was not necessarily the most important element of comfort cooling. By actual tests as reported by Mr. Torrance, the room humidity invariably ranged between 65 and 70 per cent. On one occasion, during inordinately humid weather, the amount of condensate was measured and found to be 2000 lb per hr.

Mr. Torrance described the calculations made in determining the supply air quantity and the total tonnage requirements. The air quantity was computed as follows:

Heat of the Room

Window surface: 3855 sq ft @ 1.25 Btu x 10 = 123,200.
Doors: 168 sq ft @ 1.45 Btu x 10 = 2400.
Outside wall: 7369 sq ft @ 0.07 Btu x 10 = 5200.
Skylight: 1024 sq ft @ 1.10 Btu x 10 = 11,200.
Allowance for heat of sun through window (estimated) = 32,900.
Total transmission: 175,000**.
Animal heat from 1200 people @ 400 Btu per hr: 480,000.
Total Btu: 655,000.
Tonnage: 54.
The transmission is based on 85F outside and 75F in the room and the radiation constant (sic) used is the same as that used for heating buildings in New York City.

Air Required to Cool Room

When 1 cu ft of air enters the room at 60F and is raised to the room temperature of 75F it will take up heat equal to 0.238 (specific heat) x 0.075 (lb per cu ft) x 15 deg = 0.267 Btu, hence a cooling effect of 655,000 Btu requires 655,000 ÷ 0.267 = 2,452,800 cu ft per hr of air = say, 40,000 cfm.††

To cool the outside air to the required supply conditions, Mr. Torrance calculated as follows:

40,000 cu ft x 0.075 x 0.238 x (85-60 = 17,800.
Air at 85°, 85% humidity contains 0.00154 lb per cu ft.
Air at 60°, 100% humidity contains 0.00080 lb per cu ft.
Difference condensed out = 0.00074
40,000 cu ft x 0.00074 x 966 (latent heat of condensation) = 28,600.
This moisture must be cooled to 60 and some is frozen on the pipes, requiring a cooling effect of about 8,900 Btu.
Total Btu to cool air = 55,300.
Equivalent in tons of ice cooling effect in 24 hr: 276††.

Mr. Torrance acknowledged the omission of heat losses from the bunkers and the ducts, and also the load imposed by the power to drive the fan, which amounted to the equivalent of five tons of refrigeration. However, the "margin" was adequate to care for this.

Operation, Maintenance, Power Consumption

From the operational standpoint, the plant was simple to handle. Only one man was required in regular attendance since, as Mr. Torrance explained, there were no "bearings to watch nor flywheels to start." Trading hours even in those days were from 10:00 a. m. to 3:00 p. m., so the schedule of operating procedure called for the refrigerating machines to be started at 7:00 a. m. and shut down about 4:00 p. m. The last hour of operation—sometimes it was two or three hours—assured the operator of a supply of cold brine for the next morning's run and for the kitchen refrigerators and the drinking water system. Because of these two additional loads, the plant was operated several days a week during the winter.

Air cooling promoters of the day could have pointed to the Stock Exchange as a thoroughly satisfied customer for not only did the system work but it cost very little to operate. The building supported a substantial electric load and the available exhaust steam was more than adequate. The net additional expense was for live steam to drive the ammonia and the brine pumps: this amounted to about 1½ tons of coal per 10 hr day. To this, of course, must be added the cost of cooling water. At full capacity, 9000 lb per hr of steam at 3 lb pressure was delivered to the ammonia generators. Based on this quantity of steam, the water consumption

**Author's note: For simplicity, these figures have been rounded off to the nearest 100 Btu. Allowance for the arc lights was for some reason omitted. Normally 42 of the 62-200 c.p. lamps were used. This would add a load of approximately 45,000 Btu per hr.

††Torrance, Henry, IInd International Congress of Refrigeration, Vienna 1910. English edition of the Reports and Proceedings, pp. 844, 845. General-Commissariat, Vienna (1911).

probably was in the neighborhood of 750 gpm. Even so, the plant may well be rated as one of "the most economical refrigerating plants ever installed."

Outlook for the Future

Mr. Torrance's article suggested that the Stock Exchange plant might be taken as an example of the design requirements of an air cooling job of similar character. Since the installation was eminently successful from the standpoint of performance, it follows that the method of approach had merit, that the tonnage figures were substantially correct, and that the air quantity was properly determined. The other features of design which worked out according to plan were the design inside temperature, the use of a brine tank to steady the load variations, and the allowance of an adequate "margin" as a safety factor. For purpose of reference, Mr. Torrance tabulated some of the salient facts:

Size of room: 1,240,000 cu ft.
Temperature of room: 75 to 78F.
Outside conditions: 85F, 85 per cent humidity.
Cu ft fresh air blown in per min: 40,000 to 50,000.
Maximum tonnage required to handle this work: 276.
Cu ft of space in room per ton: 4500.
Sq ft exposed area in room per ton: 670.

Looking forward into the future from those early days, it must have seemed reasonable to suppose that comfort cooling would be quickly heralded as a significant contribution to a higher standard of living—or at least a major industrial achievement. Such was not the case, however. As there was little skepticism shown during the planning stages, so there was little notice taken of air conditioning's initial success.

No doubt some of the apathy of the day is traceable to the fact that the Stock Exchange building was regarded as an unusual structure, because of its many peculiar features. There were a host of special devices: the novel annunciator boards and the intricate telephone installation; the elaborate pneumatic tube system; and the automatic time clocks. It is little wonder that air cooling was regarded as just another fancy accessory with a special application.

The few installations that followed within the next five to 10 years apparently received little or no serious attention from either the heating and ventilating industry or the general public. Consequently, little was done to develop new methods or apparatus specifically for air cooling purposes until the approach of World War I. At this time, the Stock Exchange was again thinking about another new building, and air conditioning was at the top of the list of "must" items.

Space, Weight Govern Train and Bus Conditioning

The type, location, and arrangement of air conditioning equipment used on trains and buses is primarily governed by limitations on allowable weight and space together with the amounts of electric power and water which may be provided for this purpose, according to J. D. Strobell, air conditioning engineer, Safety Car Heating & Lighting Co., and Verne Alexander, Tropic-Aire, Inc.

In a talk given at a recent meeting of the Chicago section of the American Society of Refrigerating Engineers, Mr. Strobell stressed the many limitations which are placed upon the engineer in designing air conditioning systems for railroad cars. Current practice, he says, has evolved from experience with the unusual conditions encountered and from improvements in equipment. In the majority of installations the compressor-condensing unit is located under the car floor with the evaporating coils, air distribution system, and filters in the overhead. Where d-c power is used for the compressor motors, it is generally taken from the car storage batteries which are charged by a 30 kw axle-driven generator under each car. Many installations are in service where liquid propane is used to drive the compressor engine and the use of steam jet refrigeration is not new. This latter type, according to Mr. Strobell, has certain advantages such as lower electric power consumption and a higher overall efficiency as compared to the use of the car batteries and axle-driven generator. The use of a-c equipment with d-c, a-c converters is a recent development.

It was also pointed out that the relatively low headroom in the cars imposes limitations on allowable air velocities with the result that the overhead, perforated plaque type diffusing unit is most common. The use of activated carbon for air freshening is now employed in many new cars.

At the same meeting Mr. Alexander traced the development of air conditioning in intercity buses, pointing out that the first air conditioning installation was made about nine years ago and that no real progress was made during the war. Until quite recently, he says, just about every possible type of equipment, controls, and distribution systems, have been used with varying degrees of success. As the result of actual experience by the larger bus operators air conditioning practice is now becoming more or less standardized. Most intercity buses accommodate 37 to 41 passengers and the air conditioning system is based on full occupancy, allowing 10 cfm of outside air per person. The total cooling load is generally about 4 to 5 tons.

According to Mr. Alexander, the use of air cooled condensers is mandatory and recent trends are toward the use of packaged compressor-condenser units that may be removed quickly for service and repair and in winter when the operator may obtain tax benefits due to the reduction in weight. A recent development in compressor-condenser units is the two cylinder compressor having an unloading device on one cylinder which will provide a 50 per cent capacity reduction. With this unit the compressor is driven at constant speed by an auxiliary gasoline engine, a thermostatic expansion valve is used, and a thermostatically controlled hot water reheat coil is used to control the bus temperature.

Meets Increased Central Steam Demands With 4800 Ft Tie Line

By Julius J. Schenk
and R. H. McCumber
Rochester Gas
& Electric Corp.

A part of the steam tie line, welding completed, showing the support construction

WHEN INCREASING demands for central steam in the downtown area of Rochester, N. Y., exceeded the capacity of the plant serving the district, the problem was solved by installing a tie line from Station 3, the main generating station, to Station 8, the Lawn St. steam heating plant. This line is 4800 ft long, and is designed to convey some 200,000 lb per hr of steam at 650 psi, 750 F with superheat; at the desuperheater station, it is reduced at peak to 250 psi, 500 F. A feature of the installation and an important consideration in the decision to install the line was the availability of the tunnel of an old water power raceway over 1000 ft long directly in the path of the tie line. Expansion of the portion of the line run in the race is taken care of by a large expansion loop situated in a vacant lot and caring for between 5 and 6 ft of expansion from a straight pipe run of over 1000 ft.

CENTRAL STEAM in Rochester, N. Y., has an interesting historical background. Half a century ago a laundry and cleaning company asked the Rochester Gas & Electric Corp. to supply steam for its heating and process requirements from the nearby generating station; since the station had excess steam, it seemed reasonable that it would cost less to pipe it to the laundry than for the laundry to generate it. Moreover, the utility foresaw in steam sales, the opportunity of selling electricity for power and lighting to companies depending on water power, which was becoming increasingly inadequate.

So the utility went into the steam business. As demands for steam sales grew, distribution lines from Station 3, the main generating plant, were extended. Commercial and industrial buildings in the area saw the many advantages of purchased steam, and eventually most of them were connected to the lines.

In the meantime, industrial plants and commercial buildings in other areas in the city requested that the utility also supply their steam needs. At that time, it was felt that they were too far from Station 3 to pipe steam from this source. Today's modern steam distribution systems had not yet been developed, and four plants were set up in these areas for the sole purpose of generating steam to sell to nearby customers. Recently, increased demands from commercial customers in the downtown area exceeded the capacity of the plant serving them.

Rochester's Water Power Raceways

A description of the development of central steam in Rochester must include some mention of the part water power has played in the city's history. Nothing has contributed more to the growth of Rochester than the water power furnished by the falls of the Genesee River. The possibilities of these falls were recognized at a very early date, and in 1817, a dam was constructed across the river at a spot about 400 ft south of what is now known as Court St. to store up a head of water to be diverted through a raceway, thereby furnishing power to various mills on the banks of the river. Other races were constructed, one of the most important being Brown's Race, starting at a point on the river just above the high falls on the west, and skirting the high bank for about a third of a mile.

Flour mills, who were great

users of this water power, eventually found themselves, as the country expanded westward, in a position wherein there was not sufficient grain available to make of it a profitable business for so many mills. The grain raising section of the country proceeded westward and with it the majority of the flour mills. With the abandonment of these mills, there came a gradual disuse of the mill races. New enterprises taking over buildings occupied by the mills turned to other sources for their power. Gradually, the flumes leading into the buildings were sealed off, and today there is no water flowing through them.

The abandoned tunnels of the raceways remain, and have been used to good advantage in recent years to carry many of the city's underground utility service lines thus saving considerable excavating expense. The Johnson-Seymour Race was so used for the steam line described here.

Tie Line Between Stations 3 and 8

Station 8, the Lawn St. steam heating plant of R. G. & E., supplies steam to the major part of the downtown business district of Rochester. When demands for steam in this district recently exceeded plant capacity, R. G. & E. officials had their choice of three ways to meet them:

1) Increase the capacity at Station 8 with one or more new boilers. This would entail new building construction.

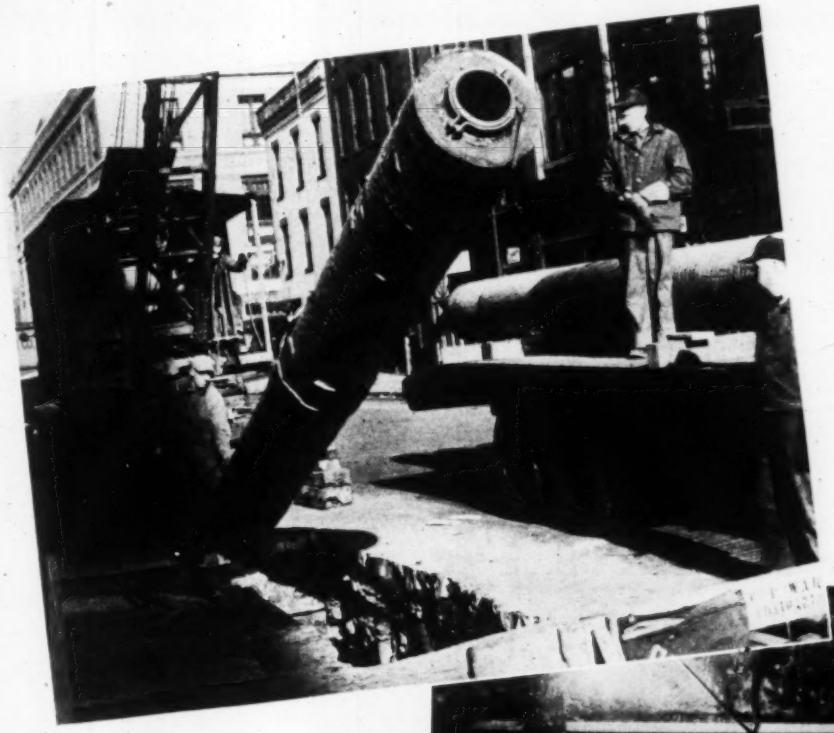
2) Construct an entirely new steam plant in the district. This would entail the purchase of expensive property, and also new building construction.

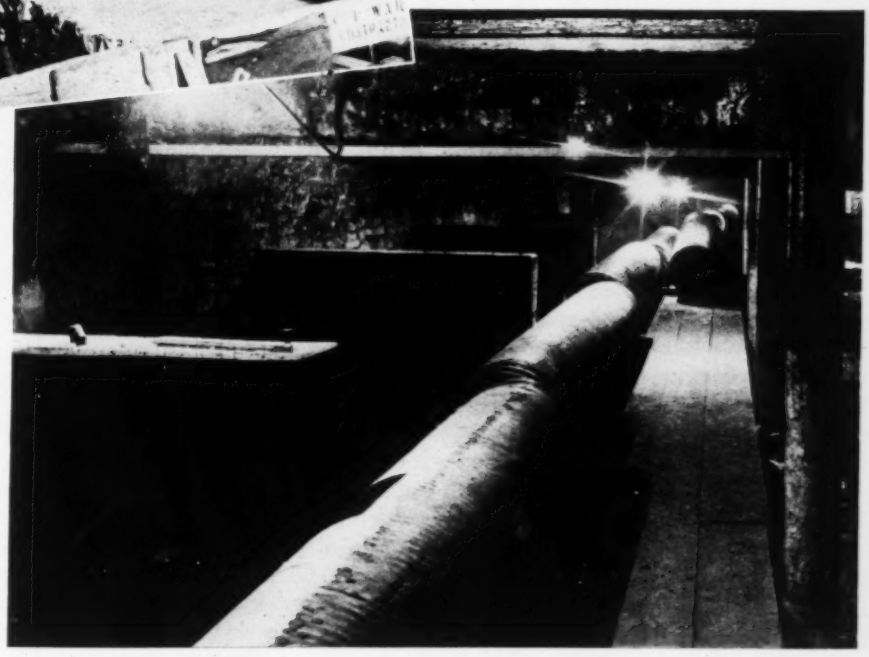
3) Install a tie line for piping steam from Station 3, the main generating station which had space capacity, into the system of Station 8.

Plan 3 was selected because cost estimates were only about one-third the estimates of plans 1 and 2. Furthermore, this scheme would utilize unused capacity of Station 3, resulting in lower overall operating costs. An important consideration in the decision was the availability of the tunnel of the Johnson-Seymour Race, over 1000 ft of which is directly in the path of the tie line. By running the line through this race, under Water St., expensive excavation and street tie-up could be avoided.

The tie line is 4800 ft long. From the point where it leaves the boiler plant at Station 3, it is supported by hangers from the sides of the building for a distance of 204 ft. After a drop of 37 ft, which takes care of expansion, it continues overhead in the river gorge, supported on steel stanchions set on concrete bases. After a run of 812 ft, it rises vertically out of the gorge. Conduit is anchored at the base of this rise, and suspended at the top by spring hangers from steel supports, to allow for expansion. Length of the rise is 65 ft.

At the top of the rise, the line turns toward Commercial St. and goes underground for a distance of 193 ft, passing under the street and under the New York Central tracks. It passes through a build-





Left: Opening through pavement and roof of abandoned raceway, through which prefabricated conduit sections 21 ft long were lowered to the raceway. Note clamp on pipe to prevent movement when unit is tilted

Bottom: Prefabricated conduit sections ready to install on concrete piers in the old raceway

ing owned by R. G. & E., emerging on the river side of the building, where it continues up the river, supported by overhead roller type hangers from the buildings, to the Andrews St. bridge.

It crosses the river supported by overhead roller type hangers on the bridge and again goes underground, under Andrews St., to Water St., where it makes a right angle turn which handles expansion to this point. It travels under Water St. for a distance of 625 ft before it enters the race.

Raceway Used As Pipe Tunnel

The raceway tunnel, about 10 x10 ft, was prepared for the conduit by erecting concrete piers. Prefabricated conduit sections 21 ft long were lowered into the race through openings at intervals in the street.

The line continues in the race for a distance of more than 1000 ft. Expansion for this entire section is taken care of by a large expansion loop, each member of which is over 150 ft. The loop is situated in a vacant lot, about midway in the line under Water St., and extending from the street to the river. Holes were cut in the race at this point, and the loop itself is supported on steel I beams mounted on concrete bases. This loop handles between 5 and 6 ft of expansion from a straight run in excess of 1000 ft.

At the far end of the line under Water St., the line emerges from the race, and enters a building adjacent to the desuperheater station. It passes through the basement of this building and rises, entering the desuperheater above ground level. The desuperheater is entirely automatic, intake of water being controlled by instruments to reduce the steam from 650 psi, 750 F with superheat, to 250 psi, 500 F, which is the standard pressure.

The 4800 ft tie line consists of 10 in. pipe, heavily insulated. All joints are welded, and must pass a 1400 psi hydrostatic test. Overhead sections of the line are insulated after erection. Underground sections, including those in the race, are prefabricated insulated pipe units with 16 ga helically corrugated steel casing. The line will move 200,000 lb per hr of steam.

The layout of the entire line, including all stress analysis and design of concrete and steel structures, was made by the engineering department of the Power Piping Div. of Blaw-Knox Co. in conjunction with the engineering and operating departments of the Rochester Gas and Electric Corp.

[Photos by Paul W. Davis, and courtesy of the Ric-wiL Co.]

Says Heat Pump Requires 1½c Rate to Compete on Cost

In order for the reverse cycle refrigeration unit to compete with other heating fuels in respect to operating costs, without considering other possible advantages, electricity at 1½c per kwhr or less must be available, according to R. A. Budenholzer, research engineer, Armour Research Foundation. This remark was made and qualified during a panel session on heat pump performance characteristics at the recent Chicago Production Conference.

A laboratory study conducted at Armour indicates that where ¾ in. copper pipe coils are buried about 6 ft under the ground surface, and where the coils are spaced about 6 ft apart, the average heat transmission should be approximately 30 Btu per hr per lineal foot of pipe, says Dr. Budenholzer. In addition, the average reduction in ground temperature, near the pipe, will be about 1 deg for each Btu per hr per lineal foot of pipe transmitted from the ground to the refrigerant. It was pointed out that these findings are based on soil conditions in the vicinity of the laboratory and that the refrigerant in the underground coils, "Freon-12," would average during the season about 20 F.

He also stated that theoretically with a 60 per cent overall motor-compressor efficiency, 20 F ground temperature, and delivering 100 deg air, a coefficient of performance of 3.3 should be obtained. Actually, however, in a great part of the country this delivery temperature would require large amounts of air for heating purposes and he considers a delivery temperature of 110 F more practical. On this basis Dr. Budenholzer believes an actual COP of about 3.2 is feasible. This, he says, can probably be obtained by subcooling the liquid refrigerant and by using a liquid-suction heat exchanger.

On the basis of this COP the heat pump would require about 1c per kwhr electricity to be equivalent in cost with coal heating and about 1½c electricity to be equivalent with oil or gas heating in the Chicago area.

BIG PORTLAND BUILDINGS TO USE HEAT PUMPS

Two of the largest structures being erected in downtown Portland, Oregon, are to be heated and cooled by water from wells, the reverse refrigeration cycle or heat pump being used during the winter months. The buildings are the 12 story Equitable and the Oregonian, for both of which J. Donald Kroeker is consulting engineer.

For year around operation, three wells are essential, according to Mr. Kroeker. One is the "heating well," to supply water around 64 deg; the other is the "cooling well," drilled to a lower level to get water at around 56 deg; and the third is the disposal well.

RADIANT HEATING PIPES LAID ON CONCRETE SLAB

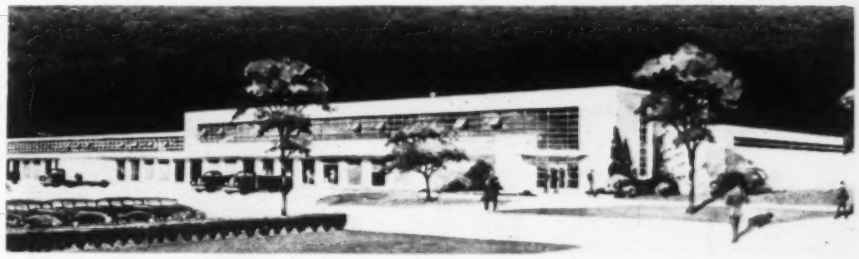
Unlike most radiant heating systems, the one for the new Atlantic Union college gymnasium at South Lancaster, Mass., consists of wrought iron pipe grids laid on a concrete slab (instead of being embedded in the concrete) with wood sleepers paralleling the pipe runs and ¾ in. soft wood subflooring and ¾ in. hardwood finish flooring laid over the sleepers. The concrete slab was treated with tar, then covered with tar paper, before pipe and sleepers were installed.

A converter supplied with steam from the college's central boiler plant will provide hot water to be circulated through the pipe grids.

Unit Heaters, Finned Pipe Radiation for Standardized Factory Building

"Typical Building for Typical Industry"

Designed by Industrial Engineers



One application of the technique, which may be used in the construction of warehouses, machine shops, and light manufacturing factories with 250,000 sq ft or more of floor space

H. K. FERGUSON CO., industrial engineers and builders, has developed a modern, steel frame, fire-resistant factory building which it is said can be built at low cost. It is a "typical building for a typical industry," and can be utilized best for warehousing, machine shops, or light manufacturing.

The low construction cost is predicated on two principal factors, simplicity of building design and simplicity of erection. Design is based on the use of standardized components throughout the entire structure.

The structure contains its own projection type heating system, complete with boilers, firing equipment, and other boiler house auxiliaries. It is well-lighted, has an approved sprinkler system, and proper underground drainage. Toilet facilities are also included.

The boilers are of the fire tube type, constructed for 100 psi working pressure, and of all welded construction. The stack is a steel guided stack arranged at the back of the boiler for a minimum amount of breeching. The boiler is automatically fired either by oil or gas burners or by a stoker. No automatic coal handling equipment is included.

Boilers are operated at 100 psi, and the steam pressure is reduced in the boiler house with a pressure reducing station to 50 psi. This makes the pressure reducing station available for attendance and regulation by the regular boiler operator.

Steam is distributed throughout the plant by an overhead, schedule 40, pipe grid distribution system. All pipe 2½ in. and over is welded, and all pipe 2 in. and smaller is screwed. The steam supply lines are insulated with standard thickness, 85 per cent magnesia, molded pipe insulation. The condensate lines are not insulated. A 50 psi steam distribution system is economical for pipe sizing, and yet the pressure is not excessive so that special valves and equipment are not necessary. If in an actual layout the problem of the flashing of the condensate arises, it is the intention to remove the flash by putting the condensate through one or two unit heaters where, of course, the heat value of the flash is made useful for heating.

Unit Heaters

Unit heaters are provided to take care of the space heating requirement. With the type of building proposed, it is possible to space the unit heaters so that each unit will service an area approximately 90 ft by 90 ft.

The unit heaters are of the projection type and are equipped with air aspirating and diffusion outlets. Due to the aspirating effect of these outlets, the temperature of the air reaching the floor is not excessive in any place and even controlled heat is produced. Each unit heater is controlled by a thermostat in the space serviced. This thermostat will turn the unit heater fan motor on and off, as required. At the thermostat there is included a selector switch so that the fan may be operated in the summertime for air circulation.

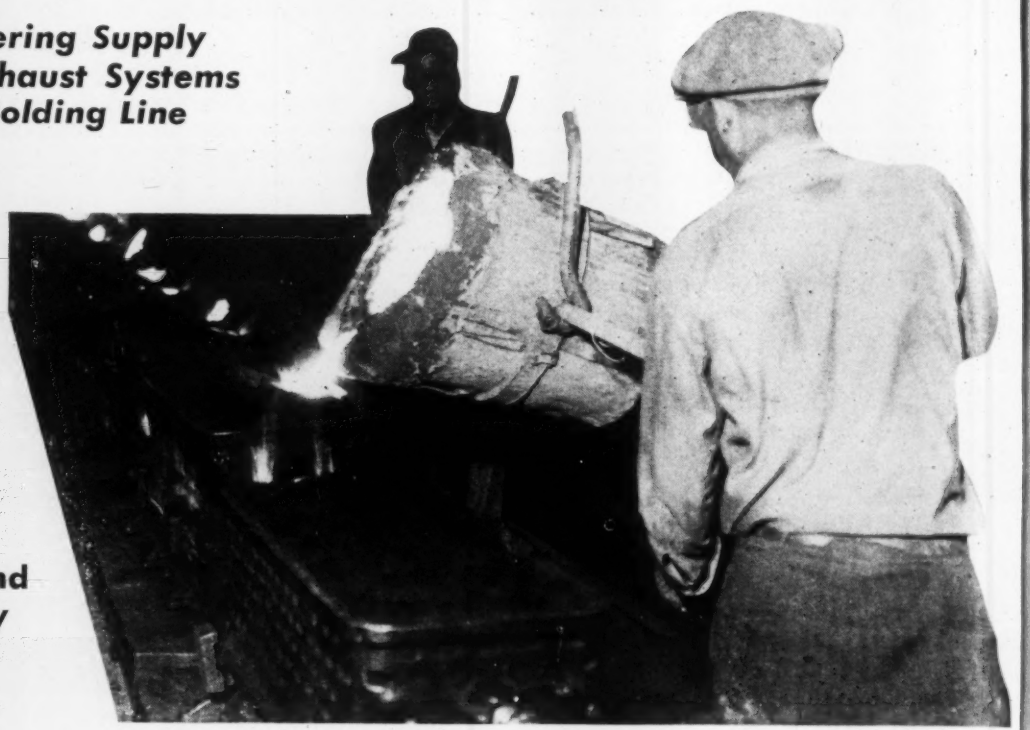
Finned Pipe Radiation

In the offices, toilets, shop rooms, etc., steel finned pipe radiation is used. This radiation is covered with a grille for appearance and safety reasons. It is, of course, mounted directly under the window and furnished with a hand valve for manual control. If there are places in the plant where sedentary workers, particularly women, are located near the windows on the outside wall, single pipe finned radiation should be installed under the window to take care of the glass losses only. In this way cold drafts are prevented from reaching the nearby workers. Any point further than 15 ft away from the windows is not subject to these drafts, and the wall radiation is not required.

FOUNDRY VENTILATION

Engineering Supply and Exhaust Systems for a Molding Line

By Jim Black and Lester T. Avery



The first place where the need for exhaust ventilation is apparent on the molding lines is at the pouring station

To ENGINEER THE supply and exhaust systems for a molding line in a mechanized grey iron foundry, let's have a general look at it to see what's cooking! There are seven molding conveyor lines and two open floor areas. The seven molding lines have nine shakeouts. All the lines are different sizes and shapes and have different sized castings and rates of travel. There are four cupolas and one electric furnace. Everything smokes, the furnaces and traveling ladles give off tremendous heat, the shakeouts give off all this and dust too.

If you do a little quick estimating, allowing a paltry 25,000 to 35,000 cfm of exhaust for each line for pouring hoods, tunnels, etc., 10,000 cfm for each shakeout, 20,000 cfm for the open floors, (3 min air change) 5000 each for the furnaces, you have arrived at a total exhaust of 375,000 cfm. To temper that much make-up air in winter takes nearly 800 boiler hp. This warns you to keep exhausts at a minimum and to make the most of every cfm you handle! A job of this size must be designed with an eye to efficiency, minimum tempered make-up air, maximum cooling, cleanest air, minimum cost. Right here you start compromising! What do you have when you're finished?

Exhaust for Pouring Station

The first place where the need for exhaust ventilation is apparent on the molding lines is at the pouring station. The completed mold, moving on the conveyor, passes by the ladle crew, who pour it full of hot metal. During pouring, the ladle smokes a little—not much—and the mold itself smokes a lot until the escaping gases catch fire. Some types of flasks on some days refuse to catch fire at all—then the smoke is terrific. This smoke must be caught in a hood.

The prime consideration in designing an exhaust hood is to get it as close as physically possible to the point of smoke or dust generation, and then a little closer! The effectiveness of a hood is inversely proportional to the square (approximately) of the distance from the work—yet it must not be in the way of the workers or the work. It must be strong enough to take a beating. It must allow for changes in the size and shape of the work. It must be flanged and shrouded with all the flanges and shrouds and baffles you can pile onto it so as to create the *maximum* air velocity over the place where the smoke is generated.

The pouring station is usually manned by one ladle crew, but sometimes two. The casting is, say, a large automotive cylinder head, weighing 100 to 300 lb. The molds come by at about two per minute (100 per hour), 4 ft apart. The conveyor speed is 8 fpm. If the line is stopped for any reason during pouring, the ladle crews move along the line until their ladles are emptied. This pouring station is 75 ft long! The pouring hood is 75 ft long, too. If it were 25 ft long, we'd need only one-third the exhaust air but there isn't any way to shorten it. They want it 75 ft.

By studying small experimental sections, stretching wires along the

station, we decided that the hood could be as close as 13 in. above the top of the flask. The smoke is relatively lazy, so no particular "capture" velocity is needed. We settled at 200 cfm per ft of hood which equals 15,000 cfm total. The air is exhausted through two slots, in the front and rear edge of the hood. The hood is in three sections, each 25 ft long, each separately exhausted.

This exhaust of 15,000 cfm of nice, warmed air is one reason for making our heating boiler so big. Knowing full well that the men will need some cool air to keep them comfortable, isn't there some way to bring this air in unheated? That would certainly be an economy. The men will need very little 0 F air to keep them cool, so where can you bring in 15,000 cfm of 0 F air? A supply duct above the hood was installed to handle raw outside air which passes through the men.

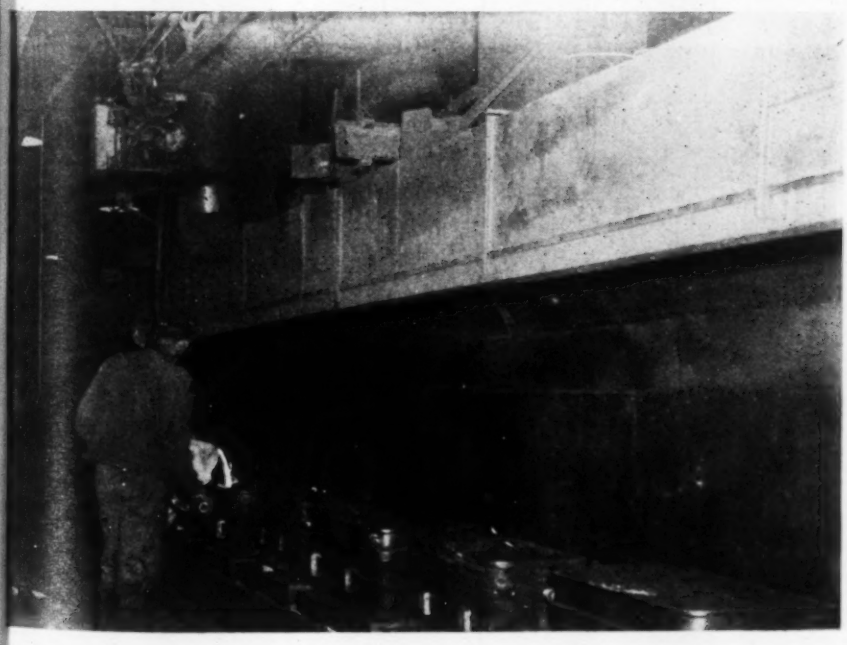
Believe it or not, this one worked — sometimes — and just long enough to persuade us to build another one like it. In any but the coldest and hottest weather the supply is o. k. In 0 F weather the men like it if they're working hard, but if production is slowed they get too cool. In very hot weather the supply isn't sufficient, but that is because of low *velocity* rather than low *air quantity*. A man exposed to radiant heat likes a *blast* of air in his *face*. The truth of the matter is that our 200 cfm of exhaust per lineal foot of hood wasn't enough, but the smoke we were catching had nothing to do with it! It was the wind! Stray air currents in the foundry blew smoke out of the hood! On still days it worked slick; on windy days when the windows were open, it didn't. *There's* something to remember—any exhaust hood must be able to absorb all the air currents blown into it. "Capture velocity" has very little to do with maximum required air quantity. Pouring hoods will vary from a minimum of 15,000 cfm to 200,000 cfm! We have seen some that big. If you favor the men with a blast of supply air in their faces, the exhaust hood must be capable of absorbing the blast.

Next Problem Is Cooling Tunnel

The next problem is the cooling tunnel between the pouring and "sprue" stations. This should be easy. All you have to do is keep the smoke that's *in* it from coming *out*. The two ends are the only openings. Make it as small as possible, just high enough to clear the flask, except that one side has to be big enough for a man to walk through for maintenance. The tunnel is 6 ft high on one side, 4 ft on the other, and 4 ft wide. The end, then, is 20 sq ft in area. Two ends total 40 sq ft, 100 fpm velocity times 40 sq ft is 4000 cfm (5000 would probably be safer), so exhaust 5000 cfm from the tunnel merely by connecting a duct to it midway between the two ends. (Incidentally, this tunnel construction provides sliding panels for conveyor maintenance along its full length and has worked out pretty well. If you have any tunnels, better make the sides removable; if you don't, they'll chop them out!)

There are three more sections of cooling tunnel along the line, so exhaust 5000 cfm from each one. So far we've used 35,000 cfm of exhaust. And so far we've made two mistakes, because here's the second one: the last two sections of tunnel connect to the outside of the building. (For some jobs they remove the casting outside.) The wind again! When the wind got into the long tunnel you can imagine what happened. A 15 mile wind moves at 1320 fpm. We increased the exhaust to 20,000 cfm in this tunnel (new ducts, separate fan) and it works fine except when the wind gets quite strong. This hasn't increased our warm air supply requirement because this air is from outside. Now we've used 50,000 cfm of exhaust.

The hood for the pouring line is in three sections, each 25 ft long, each separately exhausted



FOUNDRY VENTILATION is a tough assignment for the heating, ventilating, and air conditioning engineer, as Mr. Black, special engineer, and Mr. Avery, president, Avery Engineering Co. pointed out in the March HPAC. They describe here the engineering of the exhaust systems for one molding line in a mechanized grey iron foundry having seven molding lines, two open floor areas, four cupolas, and an electric furnace. Air quantities handled are reported, and many "words of warning" — and advice — are presented throughout the text.

Cope Shakeout Gets Special Attention

The cope shakeout takes some special consideration. At this station the cope is yanked from the drag with an air hoist and moved to a grating in the floor. A vibrator on the hoist shakes the sand from the cope, through the grating to a belt below, and the empty cope flask is returned to the molders. The drag

Before the exhaust was installed, the men who operated the cope shakeout could hardly see each other

and casting remain on the mold conveyor for further treatment. Smoke release is worse here, where the cope and drag are parted, than any other operation in the foundry. Before the exhaust was installed the men who operated the shakeout could hardly see each other.

One of the photos shows the exhaust hoods installed. The side hood catches the smoke from the flask at the "break-open" and from the drag as it moves along. It is 15 ft long, and at 700 cfm per lineal foot exhausts 10,500 cfm. The shakeout hood, which is served by a combination blower and dynamic dust precipitator air cleaner, is a hopper which brings the air outlet right up to the vibrated flask. The sand falls through the bottom of the hopper. Air velocity in the hopper is low enough and the sides of the hopper are sloped so as to prevent much sand from being carried to the air cleaner. The shakeout hood exhausts 6500 cfm. The total of 17,000 cfm of exhaust in this small area seems to be sufficient. This was one of the good ones!

Drag Shakeout a Tough Problem

The drag shakeout is the only remaining exhaust problem. It *was* impossible.

The drag is removed from the mold conveyor by two men with an air hoist with chains attached. Each man linked the chain to one end of the flask. The hoist lifted the flask, and moved on a monorail over the shakeout grate. Then the flask was lowered onto the grate. Sometimes it hit the grate and sometimes it didn't. The operation took two more men, one to remove the casting with an air hoist and hook, and one to remove the empty flask. One of the men who ran the lifting chain also had to remove the wires and gates that fell out of the flask. The conveyor was on one side of the shakeout, men worked on the other three sides, the monorail ran overhead. Sometimes the men even climbed on the shakeout when something got fouled up. (Don't try this, it's one easy way to br[eak] an ankle or leg.) There was no pl[ace] to put a hood!

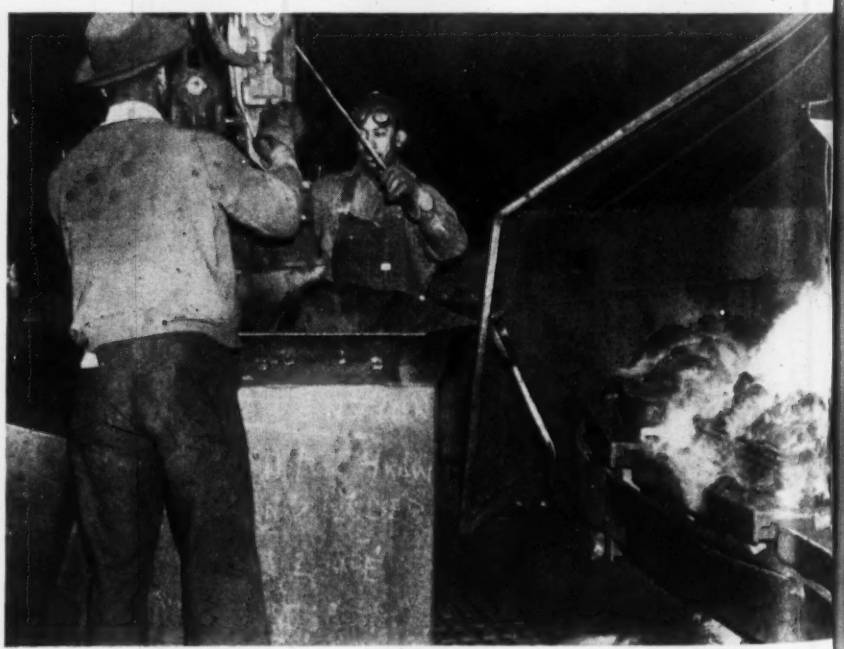
The plant engineer and th[e] fo[un]dry superintendent and the ma[in]t mechanic came to the resc[ue a]nd converted the whole operation [to] an "automatic" shakeout. Now [the] flask is pushed off the conveyor [on] the shakeout with an air ram. [It] rides across the shakeout all [by] itself and comes off the other [en]d. The hoist and monorail were d[is]continued. The hood completely encloses the entire shakeout exc[ept] for small openings at each [end] where the flask goes in and [out]. The hood exhausts 6000 cfm a[nd] works well. The drawbacks are th[at] maintenance of the shakeout is difficult because of the enclosure and the hood takes a beating wh[en] the man running the air ram h[its] the hood instead of the shakeo[ut]. This hood has to be repaired or rebuilt frequently.

Sprue and Clamp Stations

For the last item on this li[st] let's go back to the "sprue" a[nd] "clamp" stations. These are mere[ly] openings in the cooling tunn[el] where a man can get to the mold to do something to it. At the sprue station he digs the sprue out of the cope with a pry bar or a for[k]. At the clamp station a man knock[s] the clamps off the flask so the mo[ld] will come apart at the shakeout.

A sprue can weigh 2 lb or 50 l[b]

Exhaust hoods for the cope shakeout handle a total of 17,000 cfm of air



depending on the size and type of casting. It can be very hot or very cold, depending on how big it is and how long it has been in the cooling tunnel. It will create no smoke at all, or a virtual volcano, when it is removed from the mold, depending on all of the things above. If it's very hot it radiates heat to the man working, and after he has accumulated a cart full of these glowing trinkets beside him, the heat is intolerable. If it's a little too solid it will not break off, and the "desprue" has to follow it down the line punching and pounding at it to get the blankety blank thing out. If it smokes a lot, you must exhaust the smoke. If it's hot, you must supply air to the man—tremendous quantities in hot summer weather.

Air Quantities Are "Conversational"

The sprue and clamp stations on this line are 10 ft long. We put a roof over them and supplied 4000 cfm of outside air through a perforated subceiling right on top of the man. The adjacent open tunnels were to handle the exhaust. In mild or cool weather this was pretty good, providing the sprue didn't smoke too much. If the sprue smoked too much, the exhaust wasn't sufficient. In hot weather the supply wasn't enough, and wasn't directed at the man's face at high enough velocity. In cold weather the supply is too much.

There are "evil aspects" to this business of foundry exhaust design, some deep pitfalls. Minimum air quantities or velocities for a given operation, for instance, are conversational because if you double that quantity it will work twice as well. If our hoods that handle 10,000 cfm were increased to 20,000 we would have been twice as good engineers. If they're increased to 100,000 cfm they'll work wonderfully! If our side hood by the cope shakeout should be moved back a few inches from the conveyor instead of being so close that the molds rub against it, it would not be successful on 10,500 cfm. If the hood flanges are in the way of the workers and you remove them, the hood won't work on 10,500 cfm. The minimum air quantity for a hood depends on where it is in relation to the work, and a few inches counts. If it's minimum air you're after, design and install the hoods first and see where they will fit. Then design the ducts and fans and dust collectors. If you must get the job done faster than that, then all the air handling equipment must be oversized. How much oversized?

Another trap is to assume that this system, which works for one molding line, will work for the next one. On this molding line we were dealing with a casting weighing about 275 lb maximum, 90 lb minimum, and a total production of about 9 tons per hr. It has taken 73,000 cfm of exhaust. Another molding line of 11 tons per hr took 120,000 cfm of exhaust—not because the line was longer, or the hoods bigger, but because the casting was heavier, there was more iron poured, more heat, more smoke!

Says More Data Needed On Air Sterilization

Dr. R. E. Dyer, director of the National Institute of Health, U. S. Public Health Service, recently issued the following statement on the use of glycols and ultraviolet radiation in the control of airborne infections, to answer numerous inquiries from the public:

"During the past few months, several articles have appeared in the public press relative to the possible efficacy of glycol vapors and ultraviolet radiation in reducing certain infectious diseases, particularly upper respiratory diseases, such as the common cold. Due to the fact that many inquiries have been made as to the possibility of using one or both of these methods in public buildings, it is felt that a statement at this time should be made concerning the use of such installations.

"Committees of the National Research Council and the American Public Health Association have studied and reviewed the data on such installations. Within the past several weeks, these two committees separately have submitted reports. Both of these committees feel that the use of either glycol vapors or ultraviolet radiation is still purely in the experimental stage and that the data collected so far do not warrant the installation of such equipment in public buildings and industry in the hope of cutting down upper respiratory infection. The U. S. Public Health Service, through its research organization, the National Institute of Health, has conducted rather extensive studies on both glycol vapors and ultraviolet radiation and fully concurs in the reports and recommendations made by the committees of the National Research Council and the American Public Health Association. It must be emphasized that direct unshielded ultraviolet radiation of sufficient intensity to kill microorganisms in the air is also harmful to the eyes and exposed skin of humans. These observations are not intended to indicate that the future will or will not disclose new public health values in the application of either glycols or ultraviolet radiation. Much experimentation is needed, however, before a decision can be made as to whether such application may or may not be warranted."

SAME SYSTEM SERVES DINING ROOM, NIGHT CLUB

A unique feature of the air conditioning installation for the Concord hotel, on Kiamesha Lake in New York, will be the use of the same cooling and dehumidification equipment to air condition a huge night club which will be on the floor below the dining room, says the Carrier Corp.

This is being done in view of the fact that both rooms have approximately the same load and are used at different times of the day. Automatic dampers will direct the cooled air to the dining room during meal times and to the night club after 9 p. m.

The air conditioning installation was engineered and will be installed by the Greenwald-Supon Co. of Monticello, N. Y.

TIME LAG in Radiant Heating

Warren E. Wilson, Consultant, Shows Effect of Mass of Floor on Performance of Heating

USE OF A MASSIVE floor slab as the heating medium in radiant panel heating of buildings has been accompanied by certain inertial effects which are frequently objectionable. In order to fully understand the phenomena which have been observed and make it possible to predict the effect of the mass of a floor panel heating system in producing a time lag between indoor and outdoor temperature, an elementary theory of the operation of such a system has been developed and the equations describing its performance are used in the interpretation of experimental data. Confirmation of the theory by experiment justifies the prediction of performance under any given set of circumstances and with any given floor panel heating system.

It is shown that the principal factors determining the time lag of a floor panel heating system are the amount of mass located below the ducts or pipes carrying the heating medium which responds to changes in temperature of the heating medium, and the temperature of this mass at the beginning of a daily heating cycle.

The effect of the mass is illustrated strikingly by comparing the variation of indoor temperature with time during a heating cycle with underfloor masses of 10,500 and of 105,000 pounds. A ratio of time of recovery of approximately five to one is shown to exist in the two cases with 30 hr required to bring the indoor temperature with the more massive system up to comfort level.

Means of minimizing the inertial effect of the mass of the system are discussed and final recommendations include calling for reduced mass and underfloor insulation.

Theory of Operation of Floor System

The elements of a theory of the operation of a radiant floor panel heating system are relatively simple and easily understood. In Fig. 1 the essential elements of such a system are shown in a line diagram. Heat is supplied at the rate H_s by means of heated fluid passing through ducts which are located in a massive floor which may for the purpose at hand be considered to consist of an upper mass M_1 and a lower mass M_2. The building consists of rooms with walls and roof.

In Fig. 2 the first step in the distribution of the heat is illustrated. Heat is supplied at the rate H_s to the ducts through the fluid medium. This heat must be dissipated in one of three ways: It must go either upward, downward, or out through the periphery of the duct system. This elementary and perhaps trite consideration leads immediately to the vital and fundamental concept of the heat flow in this system.

In Fig. 3 further steps in the heat flow are outlined. The heat which flows downward must be dissipated in two channels. A portion H_g flows to the ground below the slab. Another portion remains in the slab to raise its temperature and the rate of storage of heat in this manner is given by the product of the rate of change of the slab temperature, its mass, and the specific heat of the mass.

The heat which flows upward is dissipated in a similar manner, part going to the warming of the mass and part to warming the air in the room. This latter rate of heat flow must equal the combined rate of flow of heat through roof and walls neglecting warming of the mass of walls and roof.

The heat flow through the perimeter of the slab is assumed to be free from inertial disturbances and is considered to be proportional to the difference in duct and outdoor temperatures.

To follow the changes in the temperatures of slab and living are under specified conditions of hea

IT IS SHOWN here that the principal factors determining the time lag of a floor panel heating system are the amount of mass below the ducts or pipes carrying the heating medium which responds to changes in temperature of the heating medium, and the temperature of this mass at the beginning of a daily heating cycle. The effect is illustrated strikingly by comparing indoor temperature variation with time for underfloor masses of 10,500 and 105,000 lb; a ratio of time of recovery of about five to one is shown to exist, with 30 hr required to bring the indoor temperature up to comfort level with the more massive system

input and outdoor temperature requires that the preceding description of the paths of heat flow be translated into mathematical language. This operation results in four equations, two of which are ordinary algebraic equations and two of which are differential equations. These four are solved simultaneously to yield a single second order linear differential equation in T_i the indoor temperature. The solution of this differential equation yields the following expression for the indoor temperature T_i;

$$T_i = c_1 e^{r_1 t} + c_2 e^{r_2 t} + AT_o + Bm + C + Dmt$$

t is the time in hours.

T_o is the outdoor temperature at the time $t = 0$.

m the rate of change of the outdoor temperature T_o whose variation is assumed linear and given by the expression $T_o = T_o - mt$

A, B, C and D are constants of the heating system including the masses M_1 and M_2, the specific heat of these masses, the heat transmission factors of wall, floor, roof, and perimeter of slab.

c_1 and c_2 are arbitrary constants determined by the initial conditions at time $t = 0$.

e is the base of the natural logarithm.

r_1 and r_2 are constants which in turn are functions of A, B, C, and D.

In the derivation of this equation several simplifying assumptions have been made but appear to be justified in an elementary treatment of this type:

1) The temperatures at all points in mass M_1 are identical at any instant.

2) The temperatures at all points in mass M_2 are identical at any instant.

3) The temperatures at all points within the fluid in the ducts are identical at any instant.

4) The ground temperature is constant.

5) The rate of heat supply from the furnace is constant.

6) The mass of walls and roof is negligible.

Theory Confirmed by Experiment

The theory, briefly outlined above, was developed about one year after a comprehensive series of temperature measurements had been made in a prefabricated "solar home" in Rockford, Ill.* These measurements provided much material which has been used to check the validity of the theory. Measurements of temperatures of room, outdoors, floor slabs, subfloor material, and ducts were made by means of a recording potentiometer and thermocouples.

The heat is supplied by means of forced air conducted through clay tile pipe and introduced to hollow clay tile which forms both the floor structure and heating ducts. The cold air is returned through subfloor tile pipe ducts to the blower.

Temperatures at various points in the structure and heating system were recorded continuously over a period of approximately two months. Several records have been selected as illustrative of important points in the operation of the radiant floor panel heating system and are reproduced in Figs. 4 and 6.

Analysis of Data

In analyzing the data it was necessary that certain assumptions be made and physical characteristics of the structure and heating system be determined. In Table 1 are shown the pertinent constants used in the calculations.

In Fig. 4 is shown the record of indoor and outdoor temperature for December 12, 1945. During the period indicated the furnace operated continuously. The smooth solid line is the calculated temperature for the period beginning at $t = 0$, shortly after sundown when the indoor temperature fell to 70 F. The plotted points represent the measured indoor temperature. This record was selected to illustrate the lag of the system when outdoor temperature falls fairly rapidly.

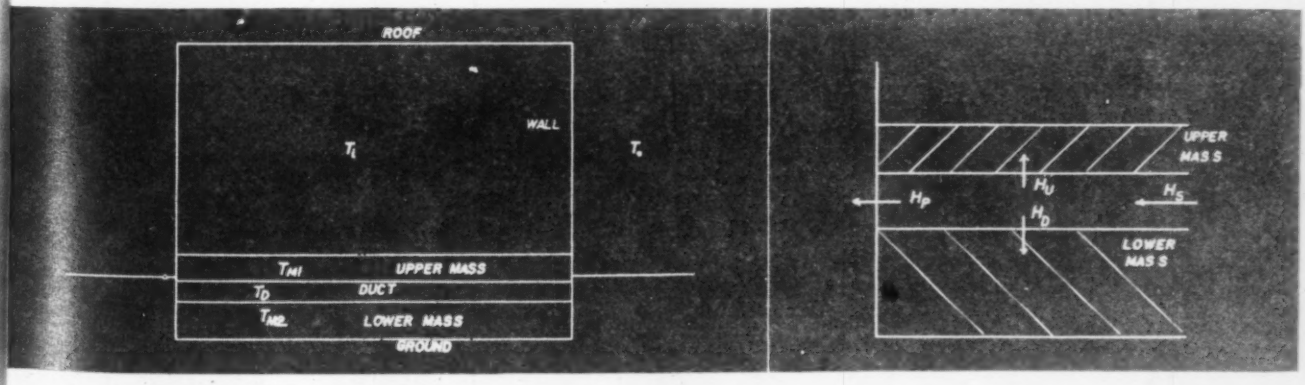
In Fig. 5 the record of January 1, 1946, is reproduced showing the same details as in Fig. 4. It will be noted that while the outdoor temperature fell less than on the previous date it was initially lower and apparently the lower mass temperature was initially so low that the system developed a very objectionable lag. It is noteworthy that during the last several hours of operation the outdoor temperature rose rapidly and the indoor temperature failed to respond. The theory explains this fully in terms of the equation given above as indicated by the solid line calculated from this equation. In Fig. 6 are shown data obtained by turning off the heater on the afternoon of January

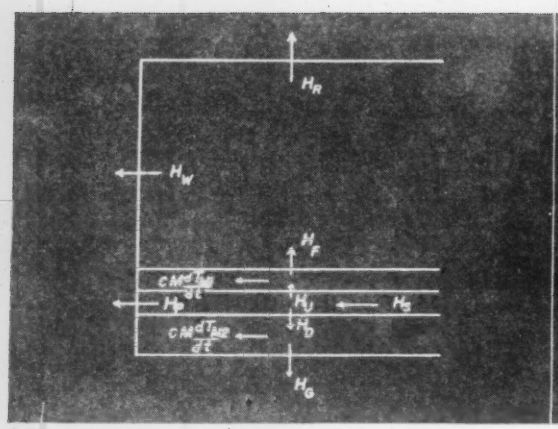
Table 1—Constants used in calculations

Lower mass, M_2	105,000 lb
Upper mass, M_1	20,000 lb
Heat loss of walls and roof	550 Btu per hr per F temp. diff.
Heat loss of perimeter	90 Btu per hr per F temp. diff.
Heat loss to ground	100 Btu per hr per F temp. diff.
Area of floor	1100 sq ft
Specific heat of mass	0.25 Btu per lb per F

*Solar House Heated by a Warm Air Floor Panel, by John E. Peterson, American Artisan, December 1946.

Fig. 1 (left)—Essential elements of radiant floor panel heating system, heat being supplied by means of a fluid passing through ducts in a floor which may, for the purpose at hand, be considered to consist of an upper mass M_1 and a lower mass M_2. Fig. 2 (right)—The heat supplied, H_s, must be dissipated in one of three ways: Up, down, or out through the periphery.





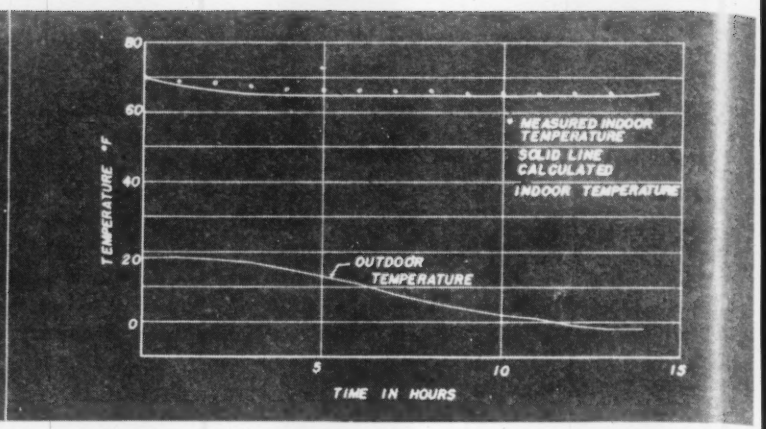


Fig. 3 (left)—Of the heat which flows downward, a portion goes to the ground and the rest remains in the slab to raise its temperature. Of heat which flows upward, part warms slab and part compensates for heat loss of walls and roof. Fig. 4 (right)—Temperature record for test structure for December 12, 1945.

22, 1946, and leaving it out of operation during the night. The agreement between theory and observation is excellent in this case and indicates clearly that the fundamental concepts included in the theory are sound and that the simplifying assumptions are either compensating in nature or do not in themselves greatly affect the accuracy of the predictions of the theory.

The warming up period following the shutdown illustrated in Fig. 7 shows good agreement between theory and observation although there is evidence that while sunlight was excluded from the living area by curtains some warming was due to solar energy since the initial rate of rise of temperature is more rapid than theory would indicate.

The experimental verification of the theory illustrated above justifies use of the equation for T_1 in discussing the effect of changing the mass of a floor panel heating system.

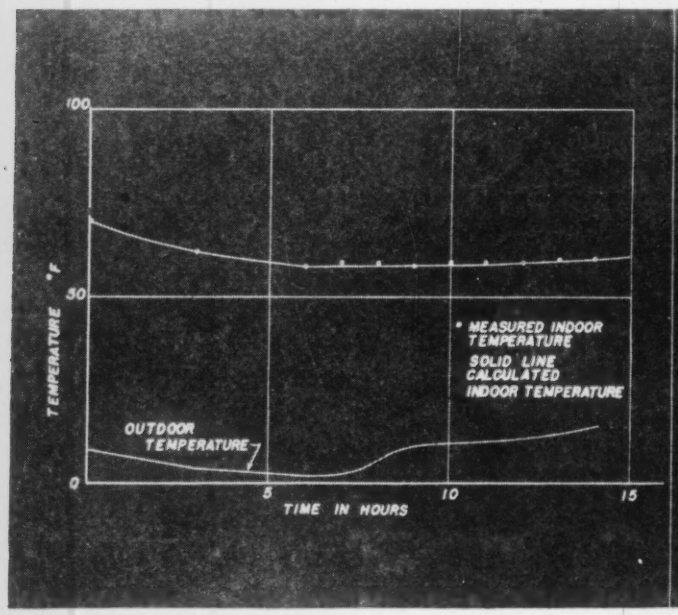
In order to carry out this discussion, Figs. 8, 9, and 10 have been prepared. To reduce the amount of mathematical work the physical constants of the structure tested have been used in preparing these charts.

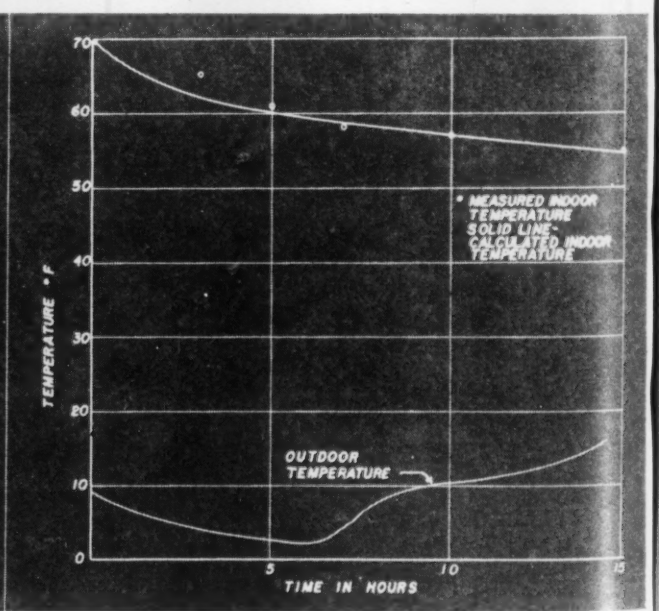
In Fig. 8 the equilibrium temperatures for lower mass T_{m2}, upper mass T_{m1}, and air in the ducts T_D are shown for any outdoor temperature T_o. The rate H_s at which heat must be supplied for a given outdoor temperature under conditions of equilibrium is also shown. It is interesting to note that during the period of record, described previously, equilibrium of the system was not attained although the capacity of the heater (65,000 Btu per hr) was more than adequate to handle equilibrium conditions.

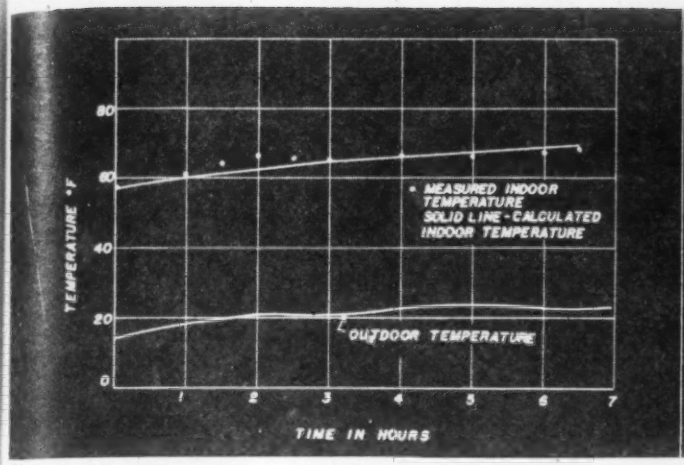
It is noteworthy that an upper mass temperature of 85 F, which is generally considered the maximum permissible for radiant floor panels, will sustain equilibrium at approximately 15 F outdoor temperature but at no lower temperature. To sustain equilibrium at —15 F, which corresponds to a rate of heat supply of 65,000 Btu per hr, the maximum attainable with the installed furnace, would require a floor temperature of approximately 96 F.

It is easily determined that were it possible to attain and maintain equilibrium neither the ground nor perimeter losses would be unreasonably large. For example, at 0 F outdoors the equilibrium conditions

Fig. 5 (left)—Temperature record for January 1, 1946. Fig. 6 (right)—Temperature record for January 22, 1946, when heater was turned off in the afternoon and left out of operation during the night.







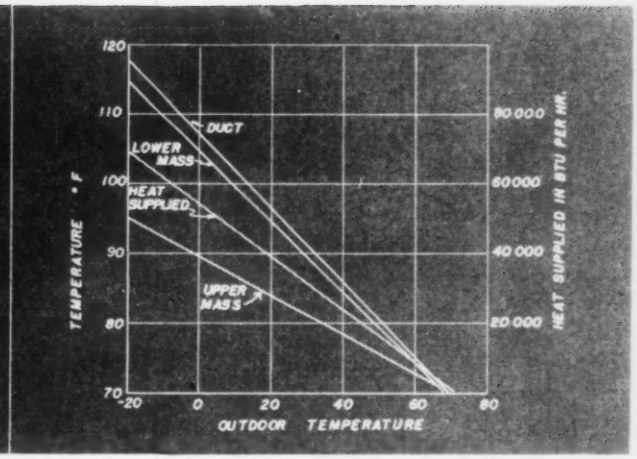


Fig. 7 (left)—The warming up period following the shutdown shows good agreement between theory and observation. Fig. 8 (right)—Equilibrium temperatures for test structure with indoor temperature of 70 F.

are:

Upper mass temperature	89.5 F
Lower mass temperature	105 F
Duct temperature	107 F
Rate of heat supply	54,000 Btu per hr
Heat loss to ground	5,500 Btu per hr
Heat loss at perimeter	9,600 Btu per hr

In this case the total of ground and perimeter losses represents approximately 28 per cent of the heat supplied.

In Fig. 9 the effect of the temperature T_{m2} of the lower mass is shown by plotting the indoor temperature T_i at the end of 10 hr of furnace operation starting with an indoor temperature of 70 F and the indicated outdoor and lower mass temperatures. It is assumed that the outdoor temperature remains constant at the figure indicated.

For example, consider these two cases:

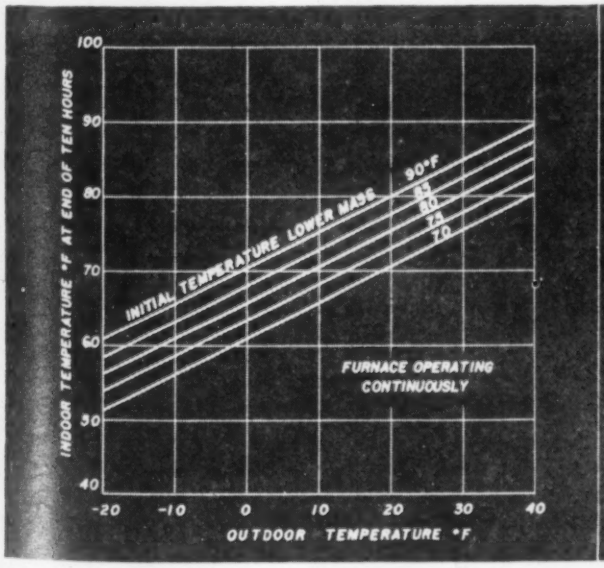
Case I: At start of furnace operation, indoor temperature is 70 F, outdoor temperature is 0 F, lower mass temperature is 70 F. At the end of 10 hr, indoor temperature is 61 F.

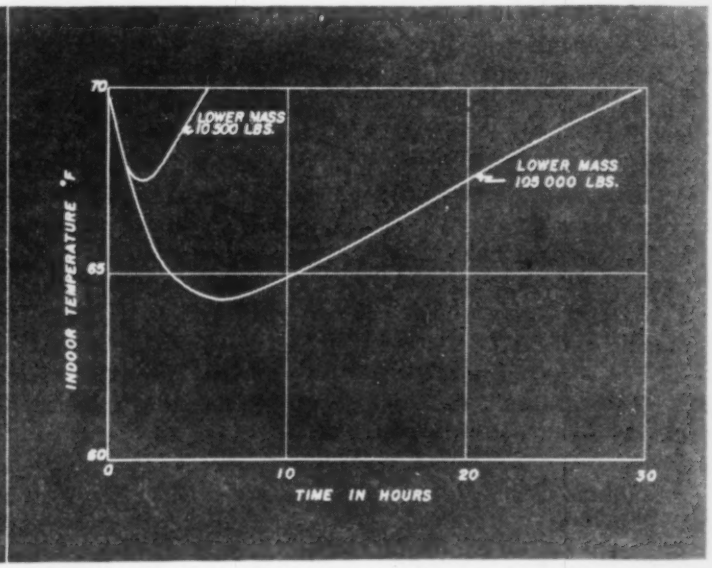
Case II: At start of furnace operation, indoor temperature is 70 F, outdoor temperature is 0 F, lower mass temperature is 90 F. At the end of 10 hr, indoor temperature is 71 F.

These cases illustrate clearly that the lower mass temperature is of vital importance in the determination of the indoor temperature at the end of a long period of furnace operation.

The effect of the amount of mass included in the lower mass M_2 is shown in Fig. 10. Initial conditions of 70 F inside and 0 F outside with a lower mass temperature of 80 F were assumed. The inside temperature at various times later was calculated and is shown graphically in Fig. 10 for two cases. In one, the lower mass was assumed to be 105,000 lb as was the case in the calculations cited previously. In the second case a mass of 10,500 lb was assumed. It is clear that the lag in the former case is intolerable since 30 hr is required to obtain a room temperature of 70 F. In the second case, the depression of the indoor temperature is less than 3 F and persists for less than 6 hr. It is true that 6 hr is too long for a recovery period but the reduction in mass is definitely effective and may be carried further in many cases.

Fig. 9 (left)—Effect of temperature of the lower mass. Fig. 10 (right)—Assuming initial conditions of 70 F inside, 0 F outside, and a lower mass temperature of 80 F, the inside temperature at various times later is shown for a lower mass of 105,000 lb and 10,500 lb. It is clear that the lag in the former case is intolerable, as 30 hr is required to obtain a room temperature of 70 F.





On the basis of the theory developed and the experimental checks obtained it is concluded that satisfactory prediction of radiant floor panel heating system performance is possible although the calculations are laborious.

This study indicates that the amount of the lower mass is of prime importance in determining the inertial characteristics of the radiant floor panel heating system.

Since it is important to reduce the amount of mass below the ducts which is influenced by the heating system it is desirable to provide insulation as close below the ducts as is feasible, thus isolating the material below the ducts from their influence.

A corollary of the theory is that the rate of change of outdoor temperature is not of great importance in determining the indoor temperature. This is a rather surprising fact which is borne out by the experimental measurements given.

The characteristics of the operation of the radiant floor panel heating system indicate the desirability of continuous operation to maintain constant temperature of the lower mass. A corollary of this is that the use of massive radiant floor panels in "solar construction" is undesirable, since the heating system does not operate during the day—thereby permitting cooling of the lower mass.

CHECK OPERATION OF STEAM TRAPS

Edward W. Longner Tells of the Common Reasons for Trap Failure

STEAM TRAPS are the "silent watchmen" that allow condensate to pass but trap steam for useful purposes. After the careful selection of the trap, it must be properly installed and last but not least, the trap must be periodically inspected, cleaned, and repaired to keep it operating efficiently.

It is important to check operation of traps frequently. There are many conditions under which traps may fail to operate properly. The following are some of the most common reasons for trap failures:

Condensate Does Not Flow Into Trap

a) Obstruction in line to trap inlet.

b) Valves leading to trap closed.

c) Bypass open or leaking.

d) Trap may be airbound.

e) Insufficient pressure to blow condensate through.

f) Improper installation of trap.

g) Accumulation of foreign matter within the trap.

h) Trap held closed by defective mechanism.

i) Strainer may be blocked.

Trap Fails to Drain or Discharge Properly

a) Discharge valve may be closed.

b) Lines may not be large enough to handle condensate.

c) Pressure may be too low to blow the condensate through.

d) Improper installation for draining.

e) Check valve may not be holding.

f) Obstruction in return line or line may be too small.

Trap Does Not Shut Off

a) Trap is too small for the condensate load.

b) Trap held open by defective mechanism.

c) Overload due to excessive boiler foaming or priming.

d) Submerged steam coils leaking.

e) Scale or foreign matter lodged in orifice.

Steam Blows Through

a) Valve mechanism does not close due to wear or defective valve mechanism or is held open by foreign matter.

b) Failed to be properly primed or be reprimed after cleanout or blowoff.

c) Bypass open or leaking.

d) Pressure too low for design capacity of thermostatic trap.

Traps need cleaning periodically. A simple device to prevent dirt from entering is to drop a short length of pipe vertically below the supply to the trap, a dirt leg, which can be cleaned easily and frequently. Traps can be seriously damaged by scale or pipe cuttings in lines. A good practice is to install strainers ahead of the traps which should be inspected and cleaned frequently.

Traps are subject to severe wear if steam blows through. They should be inspected for worn valve parts, or change in operating conditions.

When traps fail to discharge, check over the system and be sure that all units are drained with separate traps, thus guarding against short circuiting and loss of power and operating efficiency. Traps operating under high pressure or superheat are often insulated in a manner similar to adjacent pipe lines. In such cases they should be fitted with dirt pockets, test valves, and drains.

Traps on the outside or in cold places will lose heat if not insulated and may freeze unless adequately protected. Discharge lines should be short and self draining, and traps should be fitted with a drain tapping and valve.

Traps handling large volumes of air require more frequent inspection and proper venting for efficient operation. Vents should be used to avoid air binding and insure positive drainage. Gage glasses should be kept in proper repair for they indicate whether or not the trap is working.

Traps need protection from corrosion to prevent unnecessary deterioration. All valves, joints, and gaskets should be kept tight to avoid steam loss due to leakage. For continuous and efficient operation, traps require frequent inspection and examination for the purpose of elimination of foreign matter and obstructions in supply and discharge lines, and proper maintenance of the mechanism.—*from an article in Scotty-Grams, issued by the Chicago Board of Education, of which John Howatt, member of HPAC's board of consulting and contributing editors, is business manager and chief engineer.*

The manner in which glass block panels have been set back to form a part of the interior flush wall surface is clearly seen in this view of the north facade, where the sunshade screens installed on the three other walls were omitted.

This Building Must Be *CLEAN*

A NEW FOUR STORY, windowless, germ- and dustproof laboratory plant designed to be run under constant scientific control for the preparation of injectible medicines in ampuls was opened at Rensselaer, N. Y., last month by the Winthrop Chemical Co., Inc. Engineers of the Austin Co., who built it, characterized it as "one of the most complex and intricate examples of controlled conditions buildings to be seen anywhere."

Most unusual feature is the system of dedusting passageways in the basement. Before entering the main building where the ampuls are filled, all employees and visitors must walk through one of two narrow passages lined with blowing and suction units designed to remove lint and dust from their clothing.

Some 250 different medical preparations are made in 35 individual, isolated, germproofed, air conditioned, and controlled compartment laboratory workrooms.

The structure has specially insulated brick sidewalls which are constructed with a vapor barrier, and smooth glazed tile throughout the interior, where corners, ledges, and other dust collecting spots have been eliminated. With glass block in place of windows and generous areas of sash in steel partitions, excellent distribution of daylight has been provided without interfering with the maintenance of dust-free atmospheric conditions.

Suspended ceilings on the first, second, and third floors are flush, and treated with a special nonflaking plaster, with recessed, fluorescent, glass enclosed lighting fixtures, and with all piping concealed above the suspended ceiling. All floors are covered with linoleum.

Employees enter the building through the first floor lobby, and go directly to the basement to the locker rooms where they change to uniforms and pass through the dedusting passage for removal of loose particles of dust, lint, and hair. This same procedure is followed whenever the employees leave their departments to go out of the building. Visitors likewise enter through the main lobby to a visitor's room in the basement, where they are supplied with special clothing, and then pass through the dedusters.

The prime requirement of this building was to seal it in completely, and that necessitated comfort conditioning. Basically all of the numerous drugs, which are filled in ampuls in this building, are not affected by the normal temperature and humidity required for a person's comfort.

The heating and air conditioning system was designed on the following assumption: That it would be heated to 70 F in the wintertime, when outside air is at minus 10 F and the wind velocity 15 mph. In the summertime, when outside temperatures are 92 F dry bulb and 72 F wet bulb, conditions inside are maintained at 77 F dry bulb and 65 F wet bulb. These conditions are to be maintained at plus or minus 1 F dry bulb temperature, and plus or minus 2 per cent relative humidity at all controlling instruments.

Each department is zoned separately with its own controls. Several special departments require lesser humidity because of the bad effects of higher humidities on the product, and these are the arsenical room, 30 per cent relative humidity, the niphanoid and novocaine room, 25 per cent relative humidity, and one weighing room, 25 per cent. These lower humidities are obtained by means of silica gel units, which were installed together with the

required self-contained recooling units. These humidities are also maintained at plus or minus 2 per cent at the controlling instrument.

Sterilizing lamps are installed at two places in the main air conditioning ducts on each floor where the air enters from the blower before being distributed through the ducts. All outside air entering the building is first filtered through throwaway filters, and then, before being distributed through the duct system, is again filtered with electrostatic air cleaners.

All supply duct work is run concealed in the suspended ceiling space except in the basement, where it is exposed. The return air system for each floor is of the open type, making use of the corridors and stainless steel grilles from doors in each department.

The source of heat supply is the company's main central boiler plant several hundred feet away, with steam coils in the duct system.

The refrigeration equipment for the entire building, with the exception of the cafeteria penthouse, is in the basement. The refrigerant, is "Freon." Chilled and warm water are pumped to each floor.

A complete system of piping and outlets was provided on all floors to give easy access to all parts of the building for vacuum cleaning by four portable units. The central vacuum equipment is located in the equipment room in the basement.

Process piping is run through all departments and includes insulated hot and cold water piping, drainage, gas, distilled water, steam, and condensate piping.

The entire building is equipped with wet type sprinklers, concealed piping, and flush heads, where there are suspended ceilings, and exposed, where there is no suspended ceiling.

Forecasts $100 Million Annual Market for Commercial, Industrial Air Conditioning

BEGINNING THIS YEAR, $100 million will be spent annually for the air conditioning of industrial and commercial buildings, according to a published research report released by Michel-Cather, Inc., specialists in industrial advertising, sales promotion, and public relations.

Compiled under the direction of J. F. Brinley, account executive for that firm, the 26 page report, The Market for Air Conditioning in Commercial and Industrial Buildings, is based on a technical study of future markets for the air conditioning of industrial buildings, hotels, restaurants, theaters, banks, hospitals, schools, department stores, and other commercial establishments. Private residential structures are not included.

The study also confines itself to central plant air conditioning, eliminating, so far as possible, the self-contained or "package" units.

The report itself carefully details the number of establishments in each classification which could fairly be called potential air conditioning users, shows the number of such units already air conditioned in whole or in part, and the total installed horsepower through 1941. It then forecasts the air conditioning to be installed in each classification.

The summary table reproduced here presents a breakdown of the industrial and commercial classifications studied and the detailed information on each. The report, which may be secured without charge by business executives who write Mr. Brinley at Michel-Cather, Inc., 2 Park Ave., New York 16, N. Y., gives sources, complete statistics, and a full explanation of how each estimate was made.

Air Conditioning Market Survey, Commercial and Industrial Buildings

Type of Business or Building	Number of Units (Establishments)	Number Units Air Conditioned (Note *a*)	Per Cent Air Conditioned (Through 1941)	Total Installed Horsepower (Through 1941)	Horsepower per Installation (Through 1941)	Estimated Horsepower to be Installed V-I (Note *b*)	Estimated Air Conditioning Expenditure V-I Based on Horsepower (Note *c*)	Estimated Air Conditioning Expenditure V-I Based on Survey Within the Industry	Michel-Cather Estimate of V-I Air Conditioning Expenditure
Hotels	8,713	1,214	14	50,814	41	7,221	$ 7,220,000	$ 8,000,000	$ 8,000,000
Restaurants	40,000	6,583	16	96,324	14½	24,560	8,600,000	8,000,000	8,000,000
Theaters	17,919	2,238	12½	176,320	79	18,831	6,600,000	12,000,000	12,000,000
Banks	18,902	743	4	24,017	32½	5,351	1,900,000	2,800,000	2,800,000
Hospitals	6,665	527	8	7,536	14½	1,430	500,000	7,600,000	5,000,000
Schools	6,356	Not available		Not available		22,050(d)	7,720,000	10,800,000	7,720,000
Department stores	4,074	1,046	26	105,764	101	23,066	8,100,000	13,600,000	11,000,000
Other commercial	Not available	35,299	Not available	479,006	13½	133,049	46,500,000	26,500,000(e)	26,500,000
Total commercial buildings	Not available	47,650	Not available	939,781	20	235,558	$87,140,000	$89,300,000	$91,020,000
Total industrial buildings	27,000	4,759	17½	137,329	29	42,423	14,800,000	8,000,000	10,000,000
Total commercial and industrial buildings	Not available	52,409	Not available	1,077,110	20½	277,981	$101,940,000	$97,300,000	$101,020,000

a—Units having air conditioning installations, whether partial or complete.
b—Estimate for V-I is 1940 plus 1941.
c—Based on best experience available cost is assumed at $350 per hp except in case of hotels which is $1000 per hp.
d—Based on 2100 projects of which 30 per cent will have air conditioning installations averaging 35 hp.
e—Based on 5100 projects to cost $875,000,000 of which an estimated 3 per cent would be spent for air conditioning.

Design Engineer Reports on Operating Experience

PRACTICAL PIPING PROBLEMS

Oil loading docks at Curacao, showing our ship loading oil

John H. Clarke, Marine Engineer, Writes of Pumping, Piping Troubles

***FIRST-HAND** experience on how designs perform in service, how the equipment is actually operated, and what troubles are encountered were Mr. Clarke's objectives when he (a design engineer by training and profession) shipped on a tanker as junior third assistant engineer. The experience he got was most illuminating, and he reports on some of the piping and pumping difficulties here, continuing his tale from our previous issue . . . His comments and observations are of interest not only in connection with marine work, for many of them apply to mechanical equipment in plants and buildings as well . . . His seagoing phase completed, the author is now a design engineer with the Standard Oil Co. of Indiana*

THIS TIME, the journey through Chesapeake Bay was more or less uneventful—except for one thing. Everytime we had had to maneuver the ship, we had been troubled with the same serious water hammer in the 10 psi gage and 8 psi absolute extraction lines as had been encountered on the last ship. Again the suggestion was made that these lines should be drained. The chief and the first assistant thought perhaps it would be a good idea sometime, but never got around to doing anything about it. The latter was in charge of the engine room during maneuvering and in general charge of it at all other times, so it was his responsibility.

The trip off Cape Hatteras was not as rough as before, when a 25 deg roll was common, but we did run into the fringe of a storm that gave us a duly interesting time, with the usual rain, wind, and all sorts of items strewn all over the place. The foam fire extinguisher came off its hook in the galley pantry and went wild. The usual mustard, catsup, salt and so on were spread all over the decks in the messrooms, and the breakage of "crockery" by the pantry specialists was up to the best ship standards. In all, the storm was a huge success.

Oldtime Movie Comedy

The chief engineer's berth came loose from its moorings in the middle of the fracas and, with the chief as a passenger, did a trip or two across the stateroom before he could get it tied down in a safe spot. Several of the lifeboats became loose in their chocks and did a good job of banging themselves up. Up forward, the weather deck (or shelter deck) in the 'midship house was a real mess. About a half-dozen large garbage cans full of dishes and other crockery had been stowed there, but not lashed down. Several of these turned over, spilling chinaware together with other miscellaneous supplies all over the place for the full width of this deck. It was like walking in on an oldtime movie comedy, just after the dish throwing act. About two days of this jolly fun, and things calmed down and the trip took on a more leisurely aspect. We continued on to Curacao in the Dutch West Indies, via the famed Mona Pass and got a fine view of the abrupt and forbidding cliffs of the Dominican Republic coast as we went through. The day before arriving at Curacao we had our first casualty. The forward feed pump turbine shaft and thrust bearings burned out at the thrust end, so that pump was finished for awhile. This was the same pump that had just been repaired, and the bearings renewed at Baltimore.

Arriving off Curacao, we waited for about an hour before getting a pilot and heading into the port. As we approached the port, we had pumped out all but the minimum of ballast needed to hold the forward end of the ship down for safe navigation. As we proceeded toward the port, we were unable to discern any place where a ship could tie up or where there was a

protected harbor, and were somewhat mystified. However, at the last minute a hinged pontoon automobile and pedestrian bridge swung open and we proceeded through a mile long estuary to an inner lagoon harbor.

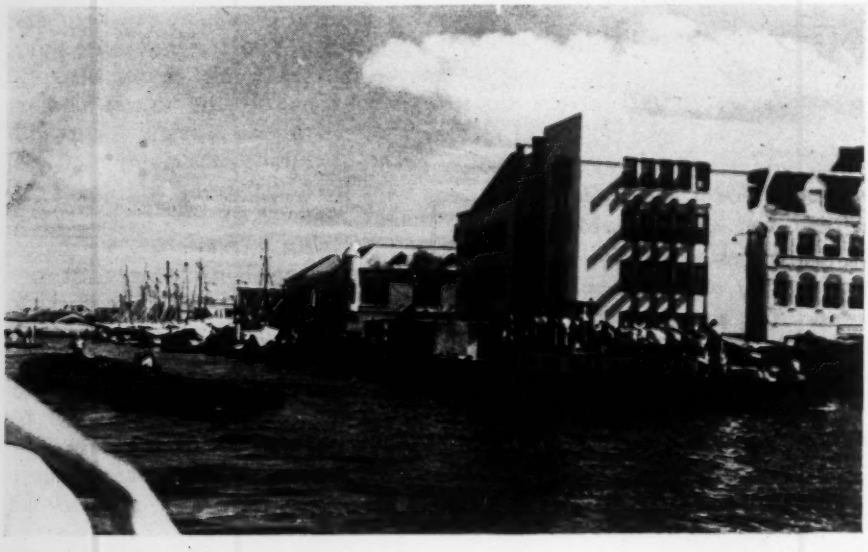
In so doing, we passed through the center of Willemstad, the capital of the Dutch West Indies, passing the governor's palace and several canals filled with fishing and other types of boats in typical Dutch style. It was all very picturesque. The inner lagoon was also interesting if for no other reason than the contrast. Directly at the end of the estuary, on the far side of the lagoon, were the oil docks and storage tanks. At the end of the estuary on the right, near side, high on a cliff, was an old Spanish fort, now used as a radar station. Beyond that and on down the lagoon were varied residential districts. On the left side of the estuary were a few more scattered residential areas with the more solid sections of Willemstad on heights a short distance back from the lagoon. The whole setting looked much like something right out of the "Spanish main," and it wasn't hard to conjure up all sorts of ideas as to what must have taken place there in the days of the buccaneers and pirates.

The next day after we had arrived, a large Spanish passenger liner came into the lagoon and anchored nearby. There seemed to be much excitement in her vicinity and we soon learned that in coming into the estuary, the steering machinery had failed, with the result that the rudder went hard over to port and the ship turned into the pontoon bridge, smashing several sections of it into kindling wood, and breaking it loose from its hinge. Such are the hazards of navigation.

As we had proceeded on our trip from Baltimore it had steadily become apparent that the conflicts and clashing of personalities on the ship were going to be the cause for a considerable amount of friction and discontent. Background and experience had much to do with this trouble. For instance, the chief mate had never sailed on a tanker before and while decidedly inexperienced in the operations of such a ship, he was equally unreceptive to asking or receiving suggestions. As the executive officer of the deck department—in charge of all cargo, rigging, and maintenance operations—this was unfortunate.

A Little Ballast Trouble

When we anchored in the lagoon, the first job was to pump out the remaining ballast on board, preparatory to docking and taking on the oil cargo. Ordinarily this is no task and should not take more than one or two hours at the most. But that was where inexperience came in. To start the operation, the chief mate was going to shift ballast from forward to aft by gravity so the ship could go into the dock,



One of the canals branching off from estuary which connects the sea and the lagoon harbor of Curacao. The sea entrance and the pontoon bridge are on the right, beyond the area shown in the picture

If you think 15 deg isn't a list, tilt a glass of water at this angle, or place a board 15 deg from the horizontal and try to stand on it

although I could never see why this was necessary. In any case, he failed to realize that the cargo (and ballast) main "tail pipes" were very much shorter to the port tanks than to the starboard tanks because the main was on the port side of the centerline. So more water flowed to the port side, in cumulative proportions. The first that we became aware of it was when the ship started to list to port, first a few degrees, then 5, 7, 10 and on and on. By this time, everyone who could be was on deck trying to figure out what was the trouble. The chief engineer was aware of the cause, but having been jumped on several times for going out of his bailiwick, kept quiet.

It was not until the ship was at a 15 deg list that the captain finally called a halt and ordered all valves secured, while a consultation took place. If you think 15 deg isn't a list, tilt a glass of water at this angle, or place a board 15 deg from the horizontal and try to stand on it. You can easily imagine what our boiler drum level gages looked like, because the drums on these ships were installed transversely. The drum gages were at one end, and the connections for the remote gages at the other, so one read full and one read empty. At the same time, we lost 3½ in. of vacuum on the main condenser. This was a two pass condenser, installed transversely with the inlet and outlet on the port side. It was because the water was running away from the second pass that the vacuum was lost.

After some extensive pow-wowing, it was finally decided to get things back to normal by flooding the starboard tanks from the sea, rather than to shift the water with the pumps (which would have been difficult) or to pump the water from the port tanks to overboard. It seemed that the harbor authorities wouldn't let us pump into the lagoon, *but of course it wasn't explained to them that it was clean ballast.* All of our tanks had been thoroughly cleaned and gas freed (as required by law for working in them) before the ship had gone to the shipyard at Baltimore. So we took on more water, then the ship went into a loading dock where we spent 27 hours pumping out the ballast through a hose to a shore sludge and oil separation reservoir. As near as we could ascertain, this was an alltime record for removing ballast. At the end of this period, nerves were slightly frayed and the chief mate was really in a state.

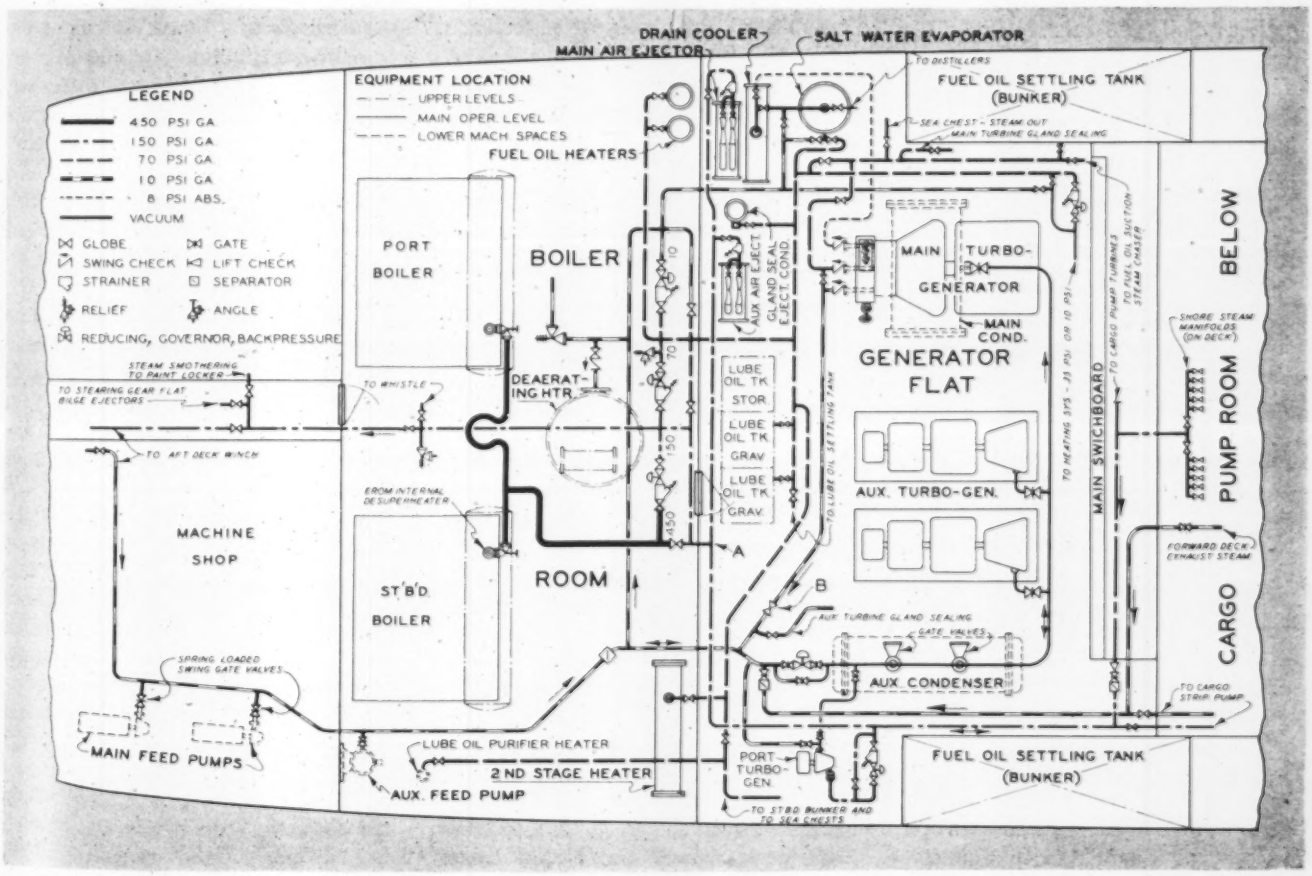
The latter was given to jumping on the others for supposedly closing or opening valves when he wasn't looking, to the point where it became a standing joke for the rest of the trip everytime something went wrong with ballasting, loading or unloading. The main trouble again was the chief mate's inexperience. Customarily the forward tanks would be pumped down first, thus shifting water aft in each tank, lifting the bow, and making it easier to take suction. Also, it was customary to operate on only one or two tanks at the most, thus avoiding losing suction on the pumps. The chief mate opened the suction valves of a number of tanks and when any tank would lose suction, they all would. This happened often and considerably slowed the pumping. Also, the piping was arranged so that the positive displacement 50 hp stripping pumps could take suction on the mains with the 200 hp centrifugal pumps. This would have maintained suction on the larger pumps and provided much more rapid discharge of the ballast. These connections were never used for the duration of the trip for this purpose, the crew apparently not being aware of this use.

Curacao was a pleasant port to visit, and the extra three days we overstayed were very enjoyable.

It was interesting to learn that while the native language had some Spanish base involved, it was not

PIPING LAYOUT

Diagram of the internal desuperheater and extraction auxiliary steam systems. The piping and machinery are shown in the same approximate location as on the ship. The elevation of the piping is indicated generally by the location of the machinery to which it connects. The auxiliary generators are driven through reduction gears, not indicated for the sake of simplicity. Note that at "A" there is no root valve for the 150 psi steam service to the forward machinery spaces; this made it impossible to repair a seriously leaking gasket on the port generator governor assembly. The 10 psi extraction valve is at "B"; this is the valve that was broken by water hammer when the ship started in to the Panama Canal. The drains for the extraction lines, reducing valve assemblies, and other piping have been omitted. While a 10 psi steam connection was provided for the auxiliary turbine gland sealing, this service was actually supplied from the 70 psi service to the main turbine. The ½ in. sealing line from the 10 psi service was inadequate, and on later ships it was necessary to increase this size to 1 in., with ¾ in. branches to each auxiliary turbine to be sure of maintaining the 1 to 2 psi sealing steam pressure. The auxiliary turbine glands were provided with carbon rings, while labyrinth sealing was provided on the main turbine



Spanish but their own. The stores as a whole were not impressive being somewhat of the bazaar type. The houses ran the gamut of all classes. But in the native quarters they were piled together on narrow little streets. It was surprising to find utter poverty in one dilapidated shanty, and in an equally dilapidated house to find reasonably good furnishings. Some of these houses were duplex jobs with a center entrance stair ascending to the second story at about a 60 deg angle, so steep you had to duck to miss the entranceway.

Ventilation wasn't too great a problem. They had shutters but no glass windows. The houses for the oil refinery personnel, however, were quite modern and located on nicely landscaped sections of the island with lovely views of the hills and the sea. One gathered the impression that this would be an interesting place to visit but as a steady diet, the closeness of it all and the constant association with the same small strata of island society all the time would soon lead, I think, to complete boredom.

We finally managed to get rid of our ballast and to take on our cargo of heavy oil, and lubricating oil in drums. The latter were stowed in a cargo hold forward. The trip to the Panama Canal was more or less uneventful except for one minor item. During fire drill, my oiler went below to start the aft fire pump. Unfortunately the vent on this pump had been tightened at one time or another and this left the vent pointing directly at the end of the 50 hp driving motor. The rest of us, in starting the pump, had been careful to shield the motor with our hands when venting the pump. This was the part the oiler evidently didn't observe. In any case, after failing to get the pump to develop pressure, he opened the vent directly on the motor, which was of the drip-proof type, and the resulting deluge put the motor out of service with a mighty "wh-a-a-a-p." Needless to say, *after* the mishap an extension was put on the vent to direct the water away from the motor and into the bilge. This was the only event of a beautiful, smooth trip across the Caribbean to Colon.

Boiler room, looking to starboard. Note how high the end of the vent trunk is and that no damper or directional terminal was provided. This made it very difficult to obtain adequate ventilation even with reasonably cool air being supplied. The two large pipes blocking the vent outlet are the main and auxiliary feed pipes. The tank at the right is the oil heating drains inspection tank. Over near the bulkhead is the second stage heater (actually a third stage heater; the drain cooler is really a first stage heater, and the dearating heater is the second stage). The boiler water sample cooler is next to the sink

It was at Colon that we really ran into a bit of trouble with our old friend, water hammer.

Whenever any trouble started, it always seemed to bring on more trouble. I got plenty of experience with this sort of thing because of being on the morning 8-12 watch. On this ship, practically everything was done on this watch, such as transferring fuel and water, or entering or leaving port. Only from the standpoint of experience could this be called good.

Our Old Friend, Water Hammer

A bit of explanation is required for a clear understanding of the background for our difficulty with water hammer. The 10 psi gage extraction line on this ship discharged into the 10 psi back pressure line which was also supplied from a reducing valve to keep the pressure up, and was provided with an automatic valve to dump steam to the condenser whenever the pressure got too high. Unfortunately neither of these valves were working properly so it was necessary to control the line pressure by hand.

The 10 psi main handled the exhaust from the feed pumps, the aft deck winch, the steam cargo stripping pump, and the forward deck auxiliaries—anchor windlass, deck winches, forward ballast pump, and forward fuel oil transfer pump. Normally only the deaerating heater took steam from this line, although it could also be used for the evaporator coils and ship's quarters heating. Anytime the anchor windlass was used, considerable quantities of water came back with the exhaust, and with the high momentary volume of steam, the pressure would build up rapidly.

The above mentioned automatic dump valve was of the self contained type, incidentally, and it is believed that the main reason it was out of service was that the pilot control ports were designed to handle steam and not water, and the considerable amount of the latter did not permit the valve to operate properly. It is my feeling that a pneumatic valve should have been used, or else a diaphragm valve with an external pilot and actuating line. There were steam separators provided for the exhaust lines to the dump valve, but the drainers for the separators must have been considerably scaled up for they were definitely not operating properly, and were shut off.

As for the reducing valve, when something was finally done about it—a month later—the trouble was found to be nothing more than a leaking diaphragm on the air operated valve. The diaphragm was baked hard by the high heat both from the steam valve itself and the air temperature which at this level was close to 140 deg.

There was one other valve on the 10 psi system, an atmospheric relief valve, provided with a screwdown adjustment so that it could be opened for operating the auxiliary turbo-generators to atmosphere when starting up the plant and before there was any vacuum in the auxiliary condenser.

With the above in mind, the method of operation was as follows: No extraction was used on the ship because the chief engineer didn't believe in it, so all the extraction valves were closed. When the pressure dropped in the 10 psi back pressure line, as it would when deck winches were shut off or when power was increased, it was necessary to close the dump valve bypass and to open the reducing valve bypass. When the ship was slowed down or when deck machinery was started up, the reverse operation was necessary. The dump valve was located on a grating a level below the generator (main turbo-generator) room, and the reducing valve was located one grating up, in the boiler room.

When we came into the breakwater at the Caribbean side of the Canal, we anchored for a short while and, after taking on a pilot, started on in toward the Canal. When the anchor was raised, the 10 psi line dump valve bypass was opened to maintain the 10 psi pressure. When the anchor windlass was stopped and the main turbine brought up to speed as the ship got under way, the pressure dropped to zero. It was at this time that the most serious water hammer took place. We were a bit busy in the engine room because we were also having trouble with the feedwater control, at the same time we were trying to straighten out the 10 psi line pressure. However, it was when I closed the dump valve bypass to bring the pressure up that it was discovered that the extraction stop valve in the line from the turbine had been broken.

The valve was a 6 in. flanged 150 lb std., cast steel globe valve with outside stem and yoke. It was located about 15 ft from the turbine. The yoke was broken at the base, at the bonnet flange, permitting the valve to open wide. Examination indicated a clean break, there being no visual evidence of poor grain structure, sand holes, or other irregularities that could have contributed to the break. This water hammer resulted from an accumulation of water in the extraction line, and could have been avoided simply by draining the line prior to any maneuvering.

Ventilating Machinery Spaces

Inasmuch as we could continue without any serious difficulty, we proceeded on through the Canal to Balboa where we were scheduled for repairs. The trip through the Canal was thoroughly enjoyable and interesting although I spent a good share of the time below at the controls. It was a warm sunny day with a moderate breeze. In the engine room, and particularly in the boiler room, it was quite hot because of the poor ventilation. As on the previous tanker, all of the machinery space ventilation was provided by cowls from the outside except for a small fan system supplying the machine shop and lower aft machinery spaces, and an exhaust system for the generator flat, the latter have the equivalent of gooseneck or mushroom vents. The boiler room ventilation was provided naturally by two 30 in. cowl ventilators and the forward part of the generator flat by two more 30 in. cowl ventilators.

The aft end of the generator flat and the forward lower machinery spaces were ventilated mechanically, a propeller type fan being provided in the trunk of the supply cowl ventilators. The only means of access to these fans was by means of a bolted plate on a boxed-in section of the vent trunk. About 50 bolts had to be removed to get at the fan and motor for inspection or oiling and, on the starboard side, the plate couldn't even be removed after unbolting because of structural interferences. Needless to say, these fans didn't get much attention.

Because of the poor ventilation in the machinery spaces and particularly in the boiler room, it was necessary to keep a wiper on the casing top all the way through the Canal to keep the cowls trimmed into the wind and thus provide the maximum amount of air. In addition, more air was provided by closing all passage doors to the machinery spaces, and other such openings, and using the two exhaust fans and the forced draft boiler fans (which took suction from the upper part of the boiler casing) to induce air to flow to these machinery spaces. As long as the firemen stood immediately under the two ventilators they could be reasonably comfortable. But at the firing aisle and at the main panel, the temperatures ranged well over 100 F.

"QUALIFIED OPTIMISM" IS ECONOMIC OUTLOOK

"A qualified optimism" regarding the continued economic good health of the United States during the coming year marks a special report on the production outlook for 1947, released last month by Major General Philip B. Fleming, administrator of the Office of Temporary Controls and John C. Houston, Jr., commissioner of civilian production.

If present tendencies continue, the report says, the value of gross national production should reach a total of $202 billion during 1947, $10 billion more than last year.

A 50 per cent dollar increase in public and private new construction, to a total of about $15 billion for the year, is regarded as feasible. OTC officials estimate that this will mean an expansion in physical volume, including highway, sewers, waterworks, railroads, etc., of about one-third over that put in place in 1946. Private residential building is expected to account for some $6 billion, as against $3.3 billion last year. With maintenance and repair, total construction may reach $20 to $22 billion.

Supplies of building materials should show wide improvement and production in general will support the increased construction activity forecast, the report indicates.

SAM LEWIS' PAGE . . . In this regular feature, informal comment on heating, piping, and air conditioning matters is given by Samuel R. Lewis, consulting mechanical engineer and a member of HPAC's board of consulting and contributing editors

Wrong Exhaust Opening Can Cause VENTILATING TROUBLES

THE TERM "chimney tops" is meant to cover not only the tops of smokestacks, but also any sort of opening from a building to the atmosphere used for escape of spent gases. The subject is suggested by recurrent illnesses in ventilating systems that I have been called on to correct.

In one case, an exhaust fan of the centrifugal type was intended to remove spent air from a large theater. Ducts in the attic connected the outlets in the ceiling of the lofty auditorium with vertical, downcoming flues running to the exhaust fan at basement level. The fan is under an open court between tall surrounding buildings and it discharged vertically through a grating in the floor of the courtway, Fig. 1. The fire escape stairways from the theater open into this court, so that the floor must be unobstructed.

In Chicago we have occasional rain and snowstorms, and the water ran through the grating onto the fan and its ducts, with the result that the fan housing and wheel were badly rusted and the wetted ducts were completely destroyed. The flanges on the structural steel beams carrying the courtway floor above the exhaust fan were eaten away completely. An attempt to reduce this destructive process had been made by covering the outlet in the courtway floor with a removable galvanized steel plate, which had to be lifted off manually when the exhaust fan was operated.

We were compelled to rebuild and to make watertight the whole floor of the courtway, since the rusted beams were seriously weakened.

We changed the ventilating principle in the theater from upfeed to downfeed, delivering the air supply through the ceiling and withdrawing the spent air through the floor.

The exhaust fan thus has much shorter suction ducts than it did when these ducts came down from the attic. We extended a discharge duct from the exhaust fan upward alongside the theater wall to a level above one's head when standing on the courtway floor, Fig. 2, this duct having a canopy over the top. The spent air is blown out on three sides of the discharge duct. Thus the exhaust fan and exhaust ducts will be kept dry.

There is a noticeable trend in many seagoing ships to give the

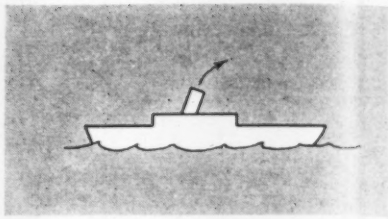


Fig. 3—Stacks on ships often have a decided rake, not only to give an appearance of speed but to aid free escape of the gases

Fig. 1—Originally, the exhaust fan for a large theater discharged up through a grating in the floor of a courtway but rain and snow water caused rusting of the fan housing, wheel, and ducts

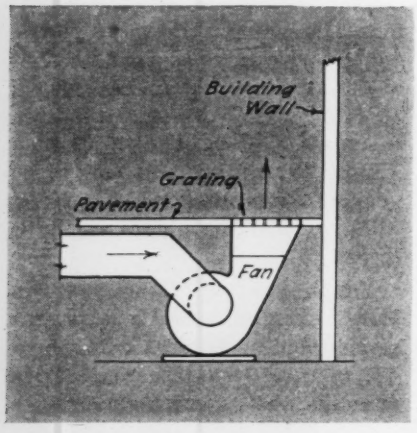


Fig. 2—A discharge duct was extended upward from the fan shown in Fig. 1. This duct has a canopy to keep the fan and duct dry

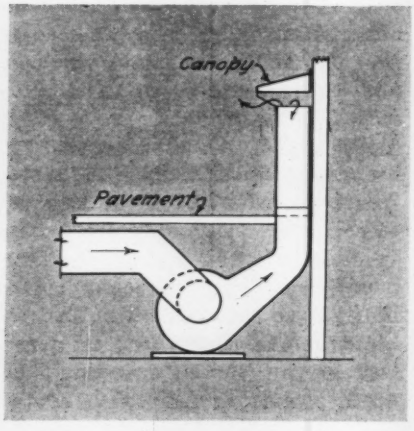
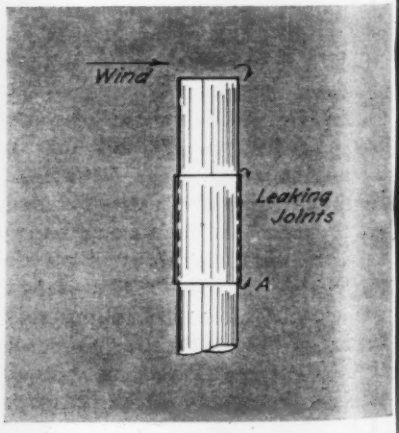


Fig. 4—When the wind velocity is high, escape of gases from a stack of this kind is seriously impeded. Pressure inside becomes superatmospheric and smoke emerges on the leeward side through cracks, as suggested by the arrows at *A*



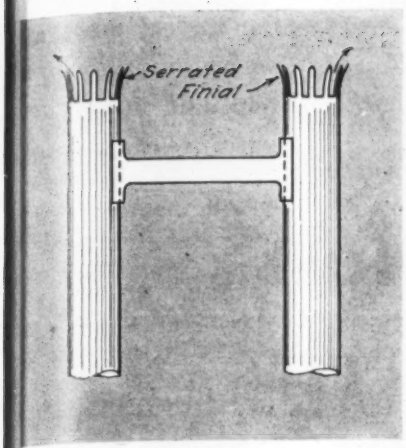
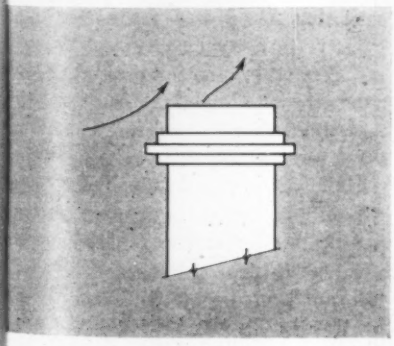


Fig. 5—**The ornamental parapets on river steamboat stacks are useful in creating turmoil to allow gases to escape despite high wind pressures**

smokestacks a decided rake, Fig. 3, so that the air currents encountered by forward movement of the vessel may induce the chimney draft. This raking of the smokestack lends an appearance of speed, but the great advantage is that the gases can escape freely. Any observer noticing a conventional round steel smokestack will see that when the wind velocity is high, escape of the gases is impeded seriously—the wind cuts off the gases almost as efficiently as if it were a damper. The pressure inside the stack, instead of being subatmospheric, becomes superatmospheric, and smoke emerges on the leeward side through cracks as suggested by the arrows at *A* in Fig. 4.

The tall steel stacks on wood-burning river steamboats frequently have ornamental parapets (Fig. 5). I suggest that these battlements or serrated finials are exceedingly valuable in creating turmoil at the chimney tops so as to allow the gases to escape despite high wind pressure.

Fig. 6—**The enlargements on brick chimney tops deflect air currents and induce chimney draft**



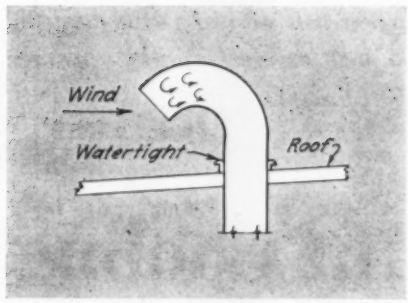


Fig. 7—**There is no excuse for a gooseneck, says Mr. Lewis, except when it is employed as the goose employs it—for intake purposes**

The oldtime, highly accomplished, journeyman brick mason loved to build finials on his chimneys in the form of corbels. These enlargements near the chimney tops deflected the air currents induced by wind pressure upward and induced the chimney draft (Fig. 6).

The present day sheet metal journeyman too frequently works for the union rather than for the owner of the building. He—or his boss—too frequently builds a ventilation

CHIMNEY TOPS—by which he means not only the tops of smokestacks but any sort of opening from a building to the atmosphere for escape of spent gases—have been the causes of illnesses in ventilating systems that Mr. Lewis has been called on to correct. He tells about some difficulties with the exhaust system for a large theater here, and goes on to discuss some of the principles involved. A suggested correction for a gooseneck outlet is given.

outlet as a fixed gooseneck (Fig. 7). This scheme works if the wind comes from the east and the gooseneck looks west, but it fails dismally and regurgitates (becomes an inlet funnel) when the wind comes from the west. There is no excuse for a gooseneck except when it is employed as the goose employs it—for intake purposes.

An acceptable outlet should look up or should look all the way around, as does a conventional fixed type ventilator. With either of these arrangements the waste air has a chance to escape.

Fig. 8 suggests a practicable correction for the difficulty with the

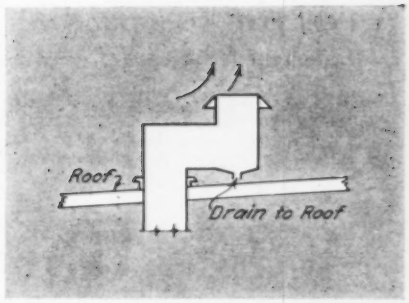


Fig. 8—**Practicable correction for gooseneck difficulties. With this scheme, the rain can drain on the roof and the gases can escape no matter what the wind direction**

gooseneck. With this open top scheme, the rain can drain on the roof and the air or gases can escape no matter from what direction the wind may come.

PUMP TOPS ALL U. S. MACHINES

The most widely used machine in the United States is not the automobile, refrigerator, or telephone but the commonplace pump.

"The pump is the unsung 'Cinderella' of the machine family," according to Richard H. DeMott, vice president of SKF Industries, Inc., in an industrial report which estimated that the national "pump population" now tops 100,000,000, constituting one of the most important uses for ball and roller bearings. He compared the pump total with 34,000,000 automobiles, 19,792,000 refrigerators and 27,800,000 telephones reported in use in this country at the end of 1946.

The centrifugal pump is the most commonly used type, the report said, and soup, castor oil, chocolate syrup, catsup and industrial coolants are only a few of the diverse liquids handled, he pointed out.

FLUORESCENT PAINT, BLACK LIGHT IMPROVE GAGE

Because visibility of the pilot gage in the boiler room of one of the Detroit Edison Co.'s plants was reported by operators as being unsatisfactory, it was decided to use fluorescent paint on larger numerals, with "black light" as the source of illumination. The new temporary gage has proved acceptable, and the problems solved in its rebuilding will be used as a design basis for new and larger dials to be installed later this year.

"OPEN FOR DISCUSSION" . . . We follow here the custom of engineering society meeting in allowing a period for questions and answers and comment following the presentation of a paper. You are invited to contribute views on published articles, other matters of importance

Radiant Cooling Must Be Designed Properly

THE EDITOR—I am glad to comment on Will D. Sampson's article in the March issue, Can't See Radiant Cooling, not only because I agree with Mr. Sampson on many points but also because I see in the installation he described a classical example of the major deficiencies of many a heating and cooling design. Although engineering science in general follows definite rules—that is, first considers the basic design conditions, then computes for these conditions, and finally designs the product to result in these conditions—the heating engineer too frequently overlooks these rules.

Possibly, this is due to the fact that the name "heating engineer" is a misnomer and should be replaced by "comfort engineer." In heating and cooling work the basic design condition should be comfort and not "heating" or "cooling" the building. Thus the heating engineer's function is to design a building of such atmospheric conditions and room surface temperatures as will provide comfort and health in summer and winter. Hence, we should compute and design for comfort only, and a system that is "unintentionally a radiant cooling system" has little resemblance to an actual radiant cooling system.

I am in full agreement with Mr. Sampson when he states that by merely cooling a ceiling surface, comfort cannot be obtained in the eastern or midwestern parts of this continent. In these areas we meet entirely different humidity conditions from those met in Switzerland, and the southwestern part of the U. S. We also have different temperature conditions than those met in Norway or the Pacific Northwest. Although it seems feasible to achieve some cooling by cooled room surfaces only, this method will prove unsatisfactory in the eastern parts of this continent unless means are provided to dehumidify the air. No matter where the building may be located, the designer will be wise to refer first to the psychrometric and comfort charts.

From these charts he can decide whether or not comfort can be insured by merely cooling some of the room surfaces. By all means the maximum—and not the mean—summer humidity conditions of the location in question should be known in order to avoid condensation at the cooled surfaces. Also, the system and equipment should be designed for humidity conditions higher than the mean summer conditions, in order to provide comfort throughout the greater part of the cooling season.

When considering all these factors, it will be found that comfort cooling by cool room surfaces only, without additional dehumidification, may be achieved only in climates of rather low summer humidities. In all other locations, dehumidification must be provided.

It may be worthwhile mentioning that in climates of medium summer humidities, considerable "relief" may be created by radiant cooling even if the air temperature is not reduced to, say, 80 F, due to the fact that the room's surfaces are cool and thus increase the body heat loss by radiation. In such climates it is quite possible to operate the cooling panel at temperatures only slightly above the dew point, and—due to the fact that in such rooms the air temperature is considerably greater than the surface temperature of the cooling panel—relative humidities still tolerable for comfort will result.—R. G. VANDERWEIL, project engineer, development department, Chase Brass & Copper Co.

DEHUMIDIFY AIR FOR PANEL COOLING?

THE EDITOR—Will D. Sampson's article on radiant cooling, in the March HPAC, is pertinent, when so many manufacturers of component parts of radiant heating equipment, as well as heating engineers are so interested in the heating phase. As Mr. Sampson states, it is easy to leave the impression that with another gadget, the panel heating system will become a cooling job.

This reminds me of my college days, when one of the subjects was "conic sections," using the textbook by C. Smith. After two or three pages of what appeared preliminary discussion, Mr. Smith would always wind up by stating "It can easily be shown that . . . etc., is correct."

At this point, please let me make it clear that I have had no experience with radiant cooling; consequently, all that follows is to be considered as my own reasoning rather than practice.

Present day air conditioning, particularly for the larger type jobs has critical ownership. There has been too much experience with jobs which work satisfactorily only when design conditions are encountered, and which are entirely unsuccessful when outside dry bulb temperature is low but humidity is high. It appears to me that the

answer to this is independent control of temperature and humidity—and this is the way most of my larger jobs are being designed.

A panel cooling job, with a separate supply of dehumidified but reheated air (possibly uncooled air from a chemical dehumidifier) may be an approach to the problem. Then the cooling panel would take care of sensible heat only. It is doubtful that this type of installation could be universally acceptable, since any space with high internal latent heat (such as a hotel room with a shower bath opening into the room) might be subject to condensation on walls. Furthermore, it appears that this would be the most expensive way to secure desirable results.

Mr. Sampson mentions his experiences with perforated ceiling air distribution. At the present time, there is a job of this type in my office for overhaul. This job was installed about 10 years ago, and the air distribution never has been satisfactory. The trouble appears to be caused by the fact that all the air is dumped into a large plenum, and must find its way out of the plenum through many small openings. In order to overcome the resistance of the openings, the supply air is under relatively high pressure, which causes the discharge from the entrance to pile up at the far end of the plenum. In theory, probably the plenum should have an equalized pressure throughout but actually this is not the case. In my opinion, the only type of perforated ceiling outlet which will be entirely satisfactory is a pressure displacement system of air distribution incorporating the use of adjustable pressure-displacement valves and perforated material zoned to meet conditions.

I might mention that as far as observed, there has been no apparent radiant cooling from this ceiling, although this may be one of the reasons for high humidity under a part of the ceiling. We hope to have this job corrected before the coming cooling season, so probably it will be impossible to make any observations. (The writer has never been in the area under discussion during the cooling season.)
—JAMES A. EVANS, consulting engineer.

Ice Rink Piping Fails During Wartime Shutdown

Paul S. Park, Engineering Service Department, A. M. Byers Co., Tells How to Prevent Trouble

DURING THE PAST year or two there have been serious corrosion problems involving brine coils in ice skating rink service. The piping failures were discovered after several years of idleness.

One deteriorated installation, on which an investigation was made, involved a rink that had been completely repiped and pressure tested with brine in 1942 and leased by the government for storage of war materials before the arena could be used for skating purposes. The system was drained but not flushed and remained under those conditions for over four years.

When this rink was returned by the government to the owners in August 1946, pressure tests immediately were conducted to determine the condition of the brine coils and almost every coil was found to be either leaking or badly corroded. The failures occurred with regularity in approximately 3 ft long sections of the coils where they extended into or out of the edge of the concrete slab base.

From visual inspection of the failed piping it was evident that corrosion had progressed from the inside to the outside of the coils. Chemical analysis of the corrosion products revealed a substantial proportion of chlorides and calcium oxide indicating conclusively that a breakdown of the calcium chloride brine in the presence of air and moisture had occurred, setting up an acid condition which—over a period of years—had proved sufficiently aggressive to corrode the pipe to the point of failure. The ends of the coils were solidly connected to the supply or return header and it was assumed that the obstructions to drainage in the form of threaded fittings, reduction in pipe size, and possible elevation of the ends of the coils because of the fixed connecting risers, were sufficient to permit small pools of aerated brine to remain in the system during and after gravity drain.

A study of available skating rink data and discussions with ice skating rink operators resulted in the formation of several useful recommendations regarding the care of the brine system during both operating and nonoperating periods—particularly the latter.

During the skating season, it is agreed by experts in the refrigeration field that the pH of a brine solution should be maintained in the 8.0 to 9.0 range, with 8.5 being a desirable minimum. Periodic tests are recommended, to be conducted by an authorized chemist or laboratory, to accurately determine the alkaline, or acid, condition of the brine. Test periods may range from one to six months, depending upon the operating characteristics of the individual system.

As added protection, some authorities suggest the use of the chromate type of treatment which has been widely accepted in the brine refrigeration field. This involves the use of chromate compounds which act as corrosion inhibitors through the formation of a stable, adherent, and nonporous film on the surface of the metal.

During the nonoperating season, or periods of extended shutdown, the consensus is that the brine system should be kept full of alkaline brine with periodic tests being made at frequent intervals to ascertain the pH of the solution. As stated before, an absolute minimum of 8.0 should be maintained with a desirable low limit of 8.5. If the system is free of leaks and devoid of air, no difficulty should be encountered in keeping the brine in a nonaggressive alkaline state.

These simple precautions have been followed carefully by the engineers in charge of the Duquesne Gardens ice rink in Pittsburgh and, despite the fact that there is no record of the addition of corrosion inhibitors, most of the wrought iron coils installed in the original system in 1899 are in use.

QUESTION OF THE MONTH . . . You are invited to submit a heating, piping, or air conditioning question for publication here. You are also invited to submit answers to these questions.

How to Stop Condensation on Confectionery Window

WE ARE DESIGNING a modern confectionery store with a front almost entirely of glass, and the problem is how to prevent condensation on the glass in cold weather, wrote "W. L." in a question published in the February HPAC. There will be no show window back. The glass extends down to within 8 in. of the floor.

Double glass was considered but it cannot be obtained in the required size. The interior of the store will be air conditioned, which means that a certain amount of humidity will always be present.

"W. L." asked for suggestions on how to meet this problem, and several are published here.

BASEBOARD RADIATOR A POSSIBILITY

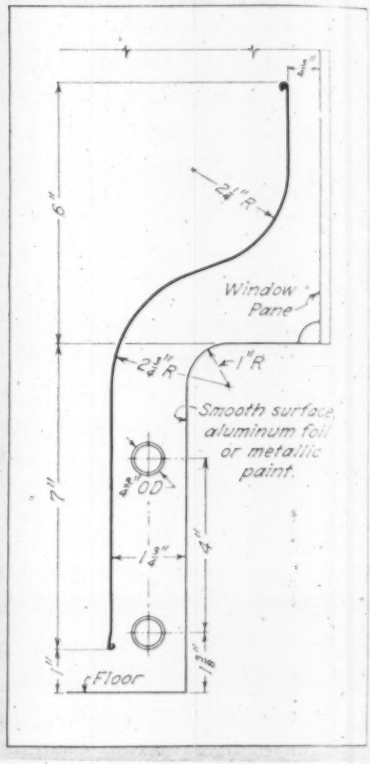
"W. L.'s" problem of preventing condensation on the glass front of a confectionery store is not new, and obviously one means of preventing this condition is to warm the surface of the glass sufficiently to prevent this condensation at the relative humidities present. The other possibility is reducing the relative humidity to the point where condensation will not form at the low outdoor temperature periods.

One possible solution of warming the glass along with producing some air movement over the glass is to use a method shown on my sketch. The principle of introducing a stream of warm air at the base of the window has been used some and has been found to be quite satisfactory. The warm air ducts to the window may be run under the floor or if the baseboard is made wide enough, it may be used for conveying the warm air to the grille at the base of the window.

Another possible solution is to use the baseboard convector radiator at the base of the windows if hot water is being used as the heating medium. However, the air motion will not be as great in velocity as with the warm air method.—R. R.

TRICK IS TO KEEP ABOVE DEW POINT ALWAYS

Condensation of moisture in the air occurs when the air is being cooled to below the dew point, or more precisely speaking, when the admixed moisture is cooled below the boiling point corresponding to the prevailing vapor pressure. Since the dew point of the air cannot be changed in the present case, the only recourse is to prevent cooling below this temperature, which occurs by contact with the window pane. The trick is to keep the temperature above the dew point at all times.

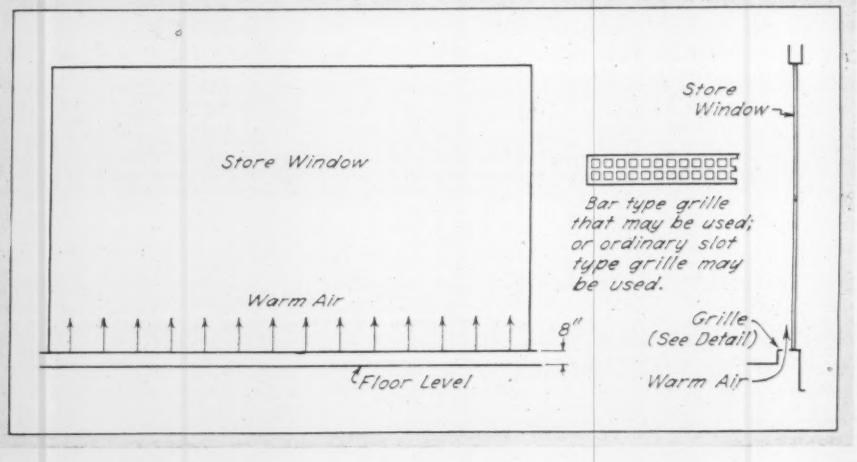


"S. R." suggests steam pipe installed in this manner

Two methods could be used. Heating the glass from within by electric current passing through wires in the glass, or heating it from without by means of warm air. The first, of course, requires wired glass and control means for adjusting the current to the demand which greatly varies with the weather. The second requires no unusual equipment.

Two ways are possible: Blowing hot air over the pane from slotted ducts as is customary with windshield defrosting in automobiles and natural draft, hot air movement. For this a steam pipe is installed as shown in the sketch and shielded against the room with a baffle which forms a draft chimney. For a moderately long window, one

"R. R" suggests either a warm air installation like this, or a baseboard convector radiator under the window

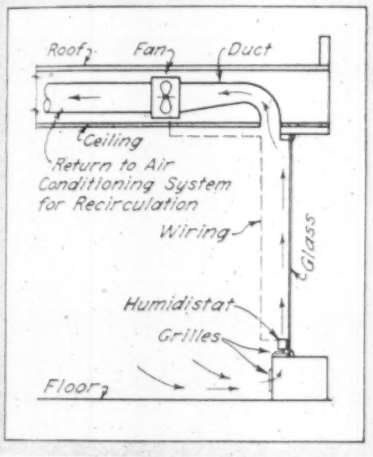


hairpin coil of ¾ in. OD copper pipe with a valve at the upper end and a trap at the lower is likely to be satisfactory even under somewhat severe conditions.—S. R.

HUMIDISTAT SHOULD BE USED FOR CONTROL

I suggest the installation of a small fan in the space between the ceiling and the roof. Place the fan in the duct with the suction near the window and discharge to the air conditioning system. Place grilles under the window as shown in the sketch.

A humidistat should be placed somewhere along the bottom edge of the glass in the window and adjusted so that when the relative humidity in the air at the window reaches the condensation point it will actuate the fan switch, thus starting the fan.



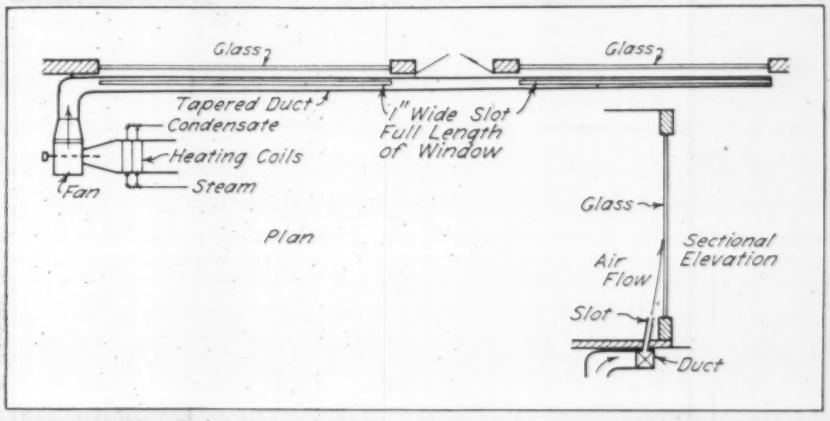
"S. R. H." submits a suggested layout involving a humidistat for automatic control

With single glass windows and 0 F outside temperature and 69 F inside temperature, condensation on the glass will begin when the relative humidity reaches about 18 per cent. The humidistat should be adjusted with this in mind.

When the fan starts it will cause the air to flow in the vertical grilles and up through the horizontal grilles along the bottom of the window and then up across the glass. This air stream should keep moisture off the glass.—S. R. H.

LAYER OF WARM AIR OVER WINDOW IS ANSWER

The following solution is offered in reply to "W.L.'s" question regarding condensation of moisture on windows. The proposed system



An installation like this or on the same basic principle will do the job, says "W. C. B."

plans a layer of warm air over the window preventing the room air from cooling to its dew point and condensing. This layer of high velocity warm air continually removes the film of cool air that is against the window. An installation as shown in my sketch—or one on the same basic principle—will do an effective job in preventing condensation on large window areas.

The fan and heating coil should be selected to provide 150 cfm at 120 F per foot of window width. The slot may be a nozzle as shown in the sketch or just a continuous slot in the duct. An average installation serving a window up to 40 ft in length should have a fan selected to deliver the required volume of air against a resistance of ½ in. SP plus heater resistance. Air supply can be either outside or return air from within the building, preferably outside air.

The slot can be located at the top of the window if necessary but the better location is at the floor. The air should be directed to strike the glass at nearly the total length of blow, thus assuring good coverage for the window.—W. C. B.

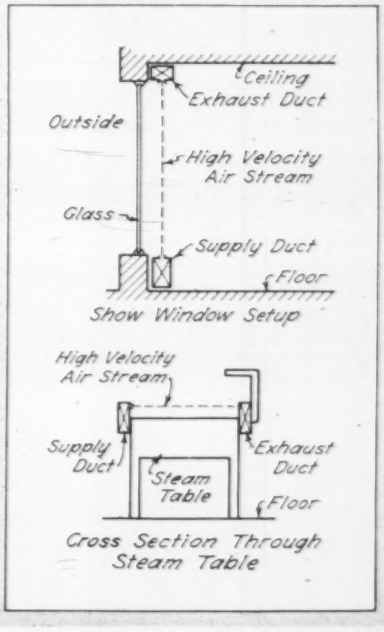
BLANKET GLASS WITH AIR CURTAIN

Show windows that are open to the store proper can be treated for winter months to prevent condensation by running a supply duct along the bottom of the window below eye level where it does not show, with a high velocity slot outlet in the top side. At the top of the show window, again out of sight, run an exhaust duct. The supply air need not be heated above room temperature or it can be used unheated. In some cases I have used room air as certain quantities must be exhausted anyway. This depends, of course, upon amounts, etc.

The exhaust fan should be sized to handle 10 per cent more air than the supply. Such an arrangement forms an air curtain against the window through which the room air cannot penetrate; hence, there is no moisture on the window. This same system may be used to advantage in the summer season if the windows face the sun at times during the day. The air stream then carries no heat other than solar heat transmitted through the glass.

In a confectionery having steam tables an adaptation of this same idea is used over the steam table.—W. D. S.

Blanketing the glass with an air curtain is the suggestion of "W. D. S." The same idea has been applied to steam tables



How to Heat Office Room in Steam Heated Garage

THERE WAS PUBLISHED in the January HPAC a question from "W. O." regarding heating an office room in a garage by means of a hot water radiator, the hot water to be supplied from a steam boiler kept at constant temperature by an aquastat. "W. O." asked if there was anything wrong with his layout, and also what kind of pump to use. Several answers to his question were published in March, starting on page 98, and more follow.

WOULDN'T ADVISE HOT WATER SCHEME

I would not recommend the installation of a small forced hot water system as planned by "W. O." for the following reasons:

1) "Home-made" manifolds by tapping a sectional boiler are generally not satisfactory over a period of years.

2) Excessive heating, due to the "main" functioning of the boiler, may corrode the manifold.

3) Life expectancy of the sectional cast iron boiler may be seriously reduced in tapping.

4) The overall operating efficiency of the boiler in mild weather may be as low as 10 per cent.

5) The standby waste of fuel, with a constant water temperature, may materially affect the annual fuel cost.

In view of the circumstances outlined above, I would recommend the installation of a one pipe steam line, with good pitch, a Hartford loop, and an excess of radiation in the office. This could be done with one or two small floor openings and tunneling the steam line approximately 30 ft to the boiler room. One or more pressure steam valves should be installed on the existing boiler header or mains and set to open at possibly 1 or 2 lb. Install a thermostat in the office, wired in secondary series with the present control system and also wired to an auxiliary boiler pressure control set to break this secondary circuit, to the oil burner when the boiler pressure reaches 1 or 2 lb.

The recommended installation would cost no more to install and probably considerably less than the proposed hot water system and by comparison increase the overall life expectancy of the system.

If "W. O." found an excessive amount of heat in the office due to the operation of the main building thermostat (this of course determined by trial and error), he could install a motorized steam valve in the boiler room line and operate this valve from a high limit control set beside the thermostat in the office. —R. D. H.

PUMP WON'T WORK INSTALLED AS SHOWN

A hot water circulator or similar pump will be suitable for this job, but no pump will work satisfactorily when connected as shown in "W. O.'s" sketch on page 98 of the January issue. To push water into a pump intake requires a certain amount of head. The arrangement of the pump intake level with the water surface in the boiler will result in insufficient water supply to the pump. The boiler should therefore be tapped at least 6 in. below the water level.

The operation of any pump involves some lowering of the absolute pressure below that prevailing at some horizontal distance in the intake pipe. Since the water is taken at boiling point temperature, some evaporation in, or already near, the pump will occur with the intended hookup, and the operation of the pump will thus be further disturbed. It should therefore be located below the point of tap, as low as at all possible.

The connection from the boiler to the pump should be ample in size with a gradual transformation at the pump intake, the first to reduce the friction head, the latter to avoid abrupt acceleration.

The connection from the pump to the radiator should be as small in area as feasible, to reduce the first cost as well as the heat loss.

The spring loaded check valve is unnecessary; there is no danger of drainage either way.—S. R.

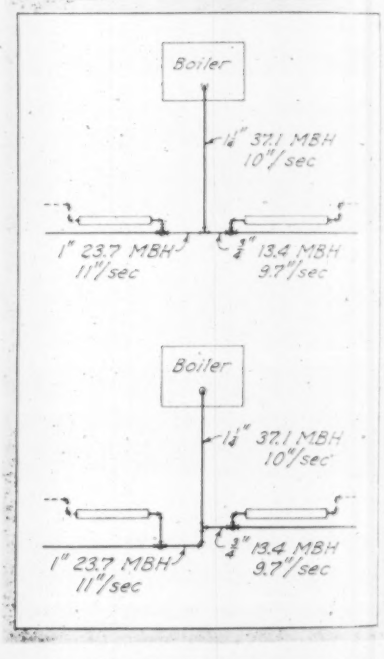
ASKS DATA ON PIPING LAYOUT

YOU ARE invited to submit a answer to the following question from "E. L. I." for publication in these pages. Suitable answers will be paid for at regular rates, with additional payment for sketches. You are invited, too, to submit a question about heating, piping, or air conditioning for publication.

In hot water heating terminology, I believe the arrangement shown in my upper sketch is called a "bull head connection."

Better Distribution?

Is there any reason to believe that the piping in the lower sketch will give any better distribution of water to the radiators? (All radiator connections are taken off the top of the main at 45 deg.) If it does give better circulation, does the advantage gained by the arrangement justify the extra cost of labor and fittings?



"E. L. I." asks if the layout in the lower sketch will give better distribution of water to the radiators than will that in the upper sketch

Is the arrangement in the upper sketch any less objectionable if the system is forced hot water with an adequately sized pump for the job? —E. L. I.

DATA SHEET

Conductivities and Conductances of Building Materials and Insulations

By Paul D. Close

TABLE 8—CONDUCTIVITIES (*k*) OF MINERAL WOOL

These coefficients are expressed in Btu per hour per square foot per degree Fahrenheit temperature difference per inch thickness

MATERIAL OR DESCRIPTION	DENSITY (lb per cu ft)	MEAN TEMP. (F)	CONDUCTIVITY (*k*)	RESISTANCE (*R*)	AUTHORITY OR REFERENCE
Glass wool	1.76	85	0.265	3.77	(6)
Glass wool	3.61	74	0.237	4.22	(6)
Glass wool	5.37	75	0.224	4.46	(6)
Glass wool	2.49	65	0.26	3.85	(6)
Glass wool	1.65	—60	0.183	5.46	(4)
Glass wool	1.65	—30	0.203	4.92	(4)
Glass wool	1.65	0	0.225	4.45	(4)
Glass wool	1.65	30	0.247	4.05	(4)
Glass wool	1.65	60	0.272	3.68	(4)
Glass wool	1.65	90	0.303	3.30	(4)
Mineral wool batts, barrier laid on warm side, 2.646 in. thick, wall vertical	2.24		0.247	4.05	(4)
Mineral wool batts, barrier lapped on warm side, 3.89 in. thick, wall horizontal	2.99		0.309	3.24	(4)
Mineral wool batts, barrier lapped on warm side, 3.89 in. thick, wall vertical	2.99		0.330	3.03	(4)
Mineral wool batts, no barrier, 3.99 in. thick, wall horizontal	1.77		0.304	3.29	(4)
Rock wool	3.5	—60	0.186	5.38	(4)
Rock wool	3.5	—30	0.198	5.05	(4)
Rock wool	3.5	0	0.216	4.63	(4)
Rock wool	3.5	30	0.238	4.20	(4)
Rock wool	3.5	60	0.261	3.84	(4)
Rock wool	3.5	90	0.287	3.48	(4)
Rock wool	10.0	90	0.27	3.70	(1)
Hand applied mineral wool, granular, 2.12 in. thick, wall horizontal	6.05		0.288	3.47	(4)
Hand applied mineral wool, granular, 3.15 in. thick, wall horizontal	6.60		0.289	3.46	(4)
Hand applied mineral wool, granular, 3.00 in. thick, with wire covering, wall horizontal	6.62		0.291	3.44	(4)
Hand applied mineral wool, granular, 3.00 in. thick, with wire covering, wall vertical	6.62		0.291	3.44	(4)
Machine blown mineral wool, granular, 3.21 in. thick, wall horizontal	5.90		0.252	3.97	(4)
Hand applied mineral wool, granular, 4.05 in. thick, wall horizontal	6.14		0.326	3.07	(4)
Hand applied mineral wool, granular, 4.05 in. thick, with wire covering, wall horizontal	6.14		0.309	3.24	(4)
Hand applied mineral wool, granular, 4.05 in. thick, with wire covering, wall vertical	6.14		0.309	3.24	(4)
Hand applied mineral wool, granular, 4.05 in. thick, with paper covering, wall horizontal	6.14		0.320	3.13	(4)
Machine blown mineral wool, granular, 4.04 in. thick, wall horizontal	5.57		0.308	3.25	(4)
Machine blown mineral wool, granular, 4.07 in thick, with wire covering, wall horizontal	5.70		0.289	3.46	(4)
Machine blown mineral wool, granular, 4.09 in. thick with wire covering, wall vertical	5.84		0.291	3.44	(4)
Machine blown mineral wool, loose, 4.14 in. thick, wall horizontal	6.39		0.329	3.04	(4)
Mineral wool batts, barrier lapped on warm side, 3.478 in. thick, wall horizontal	3.67		0.295	3.39	(4)
Mineral wool batts, barrier laid on warm side, 2.646 in. thick, wall horizontal	2.24		0.261	3.84	(4)

TABLE 9—CONDUCTIVITIES (*k*) OF LOOSE FILL MATERIALS AND INSULATIONS (OTHER THAN MINERAL WOOL)

These coefficients are expressed in Btu per hour per square foot per degree Fahrenheit temperature difference per inch thickness

MATERIAL OR TRADE NAME	DESCRIPTION	DENSITY (lb per cu ft)	MEAN TEMP. (F)	CONDUCTIVITY (*k*)	RESISTANCE (*R*)	AUTHORITY OR REFERENCE
Granular insulation	Made from combined silica of lime and alumina	4.20	72	0.24	4.17	(3)
Kapok	Loosely packed	0.87	84	0.24	4.17	(1)
Pal-O-Pak	Fluffy cellulose material	3.00	75	0.24	4.17	(3)
Regranulated cork	Particle size about 3/16 in.	8.1	90	0.31	3.22	(1)
Redwood bark		3.00	90	0.31	3.22	(1)
Redwood bark		5.00	75	0.26	3.84	(3)
Redwood bark		4.90	—60	0.198	5.05	(4)
Redwood bark		4.00	—30	0.213	4.69	(4)
Redwood bark		4.00	0	0.229	4.36	(4)
Redwood bark		4.00	30	0.247	4.05	(4)
Redwood bark		4.00	60	0.263	3.80	(4)
Redwood bark		4.00	90	0.282	3.55	(4)
Sawdust	Various woods	12.0	90	0.41	2.44	(1)
Shavings	Planer, various woods	8.7	86	0.40	2.50	(1)
Thermofill	Powdered fill insulation	34.0	90	0.60	1.67	(1)
Thermofill	Powdered fill insulation	26.0	90	0.52	1.92	(1)
Thermofill	Powdered fill insulation	19.8	90	0.35	2.86	(1)
Thermofill	Powdered fill insulation	24.0	75	0.48	2.08	(3)
Thermofill	Powdered fill insulation	18.0	75	0.34	2.94	(3)
Vermiculite	Expanded vermiculite			0.48	2.08	(1)
Vermiculite	Expanded vermiculite, particle size—3 + 14	6.2		0.32	3.12	(3)

References—see last column of tables:

(1) United States Bureau of Standards. (2) Tests conducted at University of Illinois by A. C. Willard, L. A. Harding, L. C. Lichty, and others. (3) Tests conducted at Illinois Institute of Technology (Armour Research Foundation), by J. C. Peebles. (4) Tests conducted at University of Minnesota, by F. B. Rowley, et al. (5) American Society of Heating and Ventilating Engineers Research Laboratory. (6) Tests conducted at Pennsylvania State College by Hechler and Queer. (M) Data from manufacturer; authority not stated.

CONDUCTIVITY AND conductance values have been compiled by the author from published sources and are given in Tables 1 to 11 inclusive. It will be noted that the values in Tables 1, 3, 6, 7, 8, 9, 10 and 11 are conductivities (*k*) and are therefore based on a 1 in. thickness of the material reported in each case. Tables 2 and 4 are conductances (*C*) and are for thicknesses other than 1 in. or for combinations of two or more materials. Table 5 contains both conductivity and conductance values. All coefficients express the rate of heat transfer between the material surfaces in Btu per hr per sq ft per deg Fahrenheit temperature difference per inch thickness (where the conductivity is given) or for some other thickness or combination of materials (where the conductance is given). Resistances (*R*) or resistivities, which are the reciprocals of the conductances or conductivities, are also listed, as well as the authorities in each case.

The tests were conducted by generally reliable sources. There is no certainty, however, that the figures for proprietary materials correspond with those for similar materials purchased in the open market. These and other pertinent facts should be considered when using these data.

Tables 1 and 2 were published in January, Tables 3 and 4 in February, and Tables 5, 6, and 7 in Mareh. Tables 8 and 9 appear this month, and the others will follow.

[Note: Mr. Close is technical advisor for Simpson Industries, Inc., sales division of the Simpson Logging Co. He was formerly technical secretary of the Insulation Board Institute, and before that was technical secretary of the American Society of Heating and Ventilating Engineers.]

Heating, Piping & Air Conditioning

AMERICAN SOCIETY of HEATING and VENTILATING ENGINEERS

Journal Section

PROCEEDINGS of 53rd Annual Meeting ASHVE

(Concluded from March Journal)

AT the 53rd Annual Meeting of the Society held in Cleveland in conjunction with the 7th International Heating and Ventilating Exposition at Lakeside Hall, an attendance of 2165 proved to be the largest in Society history.

A feature of the first session was the dedication of the new Research Laboratory at 7218 Euclid Ave., at ceremonies attended by 500 members and guests. A report of the first session appeared in the March 1947 JOURNAL SECTION.

Research Regulations

The second technical session convened at 9:45 a. m. January 28, in the Ballroom of Hotel Statler, Cleveland, Ohio with 2nd Vice Pres. G. L. Tuve, Cleveland, presiding.

Chairman Tuve stated that the first order of business was to consider the proposed amendments to the Regulations Governing the Committee on Research which were endorsed by the Council and submitted to members of the Society in accordance with **Article** B-I, *Section 10* of the By-Laws as follows:

Article V—Government

Section 6. Headings of Papers—All papers, findings, or reports resulting from the work of the Committee on Research shall, when published by the Society, be headed as follows:

(*a*) If the paper, finding, or report is the result of work at the Society's Research Laboratory, the following statement shall be used: "This paper is the result of research carried on by the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS at its Research Laboratory located at 7218 Euclid Ave., Cleveland, Ohio."

(*b*) If the paper, finding, or report is the result of cooperative work with some institution or laboratory other than the Society's Research Laboratory, the following statement shall be used: "This paper is the result of research sponsored by the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS in cooperation with (name of institution)."

Article VI—Patents

Section 1. If any invention or discovery is made by a member or members of the research staff of the Society which is deemed worthy of patent application by the Committee on Research, such application shall be made in the name of the inventor and assigned to the Society. When issued the patent shall be held by the Society in trust for the benefit of the public.

Section 2. If any patentable invention or discovery is made under cooperative research agreements between the Society and a University or College, the Committee on Research shall determine the conditions

SUMMARY—The effects of moisture content on odor diffusion in the air, various phases of dehumidification such as tests for rating equipment and installation methods and applications, human tolerance to heat, the control of panel heating systems, methods used in determining the health hazards arising from the inhalation of various toxic substances, and the minimal air replenishment required for living spaces are among the important subjects covered in technical papers which were presented at the recent 53rd Annual Meeting. Discussions of these papers and the lively radiant panel heating forum highlight these Proceedings. The installation of officers, the work of various committees, and other official business are also recorded.

under which patents shall be controlled so as to produce the greatest benefit to the Society and to the public.

Secretary A. V. Hutchinson explained that the changes in **Article V** were made necessary by the transfer of the Research Laboratory from Pittsburgh to Cleveland. He stated that the amendments to **Article VI** on Patents were also made necessary by the transfer of the Laboratory from Pittsburgh, where it was necessary to conform to certain rules of the Department of the Interior which provided the laboratory space.

Chairman Tuve explained that the change in **Article VI**, *Section 2*, made it easier to meet the requirements of various institutions conducting research in cooperation with the Society.

On motion of H. M. Hart, Chicago, Ill., seconded by R. C. Thomas, Norfolk, Va., it was

VOTED: That the proposed amendments to the Regulations Governing the Committee on Research be adopted.

Humidity and Odor

Chairman Tuve then introduced Dr. R. L. Kuehner, York, Pa., who presented his paper, **The Effects of Moisture Content on the Diffusion of Odors in the Air,** (published in the December 1946 JOURNAL SECTION, *Heating, Piping & Air Conditioning*).

W. L. FLEISHER, New York, N. Y. (WRITTEN): The conclusions drawn from this paper, presented by Dr. Kuehner, were indeed gratifying as far as my own reactions are concerned. The world is so filled with people who accept hearsay as fact that the amount of rubbish spoken and published about humidity in any form has been one of the dominant misconceptions in all air problems.

It has been my contention, as many people here know, that the proper moisture content of the air is one of the fundamental and basic requirements for health and comfort. There has been so much unfavorable comment on relative humidity as an adjunct to air conditioning that it is interesting at last to find a group of investigators who categorically state that the relative humidity of the air is not a function of odor diffusion; that of the five basic odors, three seem to diffuse better in 100 per cent saturated air and two better in zero saturation and that actually the diffusion of odors is, to a great extent, or as far as the average person can discern, independent of the relative humidity.

There are so many groups who either condemn the use of moisture in the air to increase comfort due to various factors affecting material objects rather than the psychological and electrical equilibrium of the people that it is gratifying to find fallacious at least one point, which has always been cited against proper humidification.

C. S. LEOPOLD, Philadelphia, questioned the importance of rate of diffusion in still air because, in a ventilated structure, the minimum air movement would be 10 to 15 fpm, which could even be produced by thermal convection currents. For instance, if silica gel were placed in the central flask of Fig. 1 and the gas cocks were open for a long time, it is probable that very little moisture would be collected by diffusion because of the slow rate of diffusion.

Referring to a previously published paper[1], the authors measured chemically one odor producing substance from wood and found the odor produced almost directly proportional to the relative humidity. He also remarked that similarly a group of people will be more odorous in a hot humid atmosphere than a cool dry one.

MR. LEOPOLD suggested that the sensitivity of the human nose might be affected by temperature and humidity and, if so, it would not be a reliable instrument for determining extreme limits.

DEAN L. E. SEELEY, Durham, N. H., stated that the hygroscopic properties of rubber tubing would not permit a sample to remain unchanged while passing through the tubing.

AUTHOR'S CLOSURE: Dr. Kuehner agreed that neither zero nor 100 per cent relative humidity was obtainable in the experiments and, therefore, the terms were considered relative instead of exact. He had found that the rubber tubing used in the first experimental apparatus, even when cleaned with a dichromate cleaning solution, still gave traces of odors and prevented checking of results in repeated tests.

Rate of odor diffusion in still air was nevertheless considered applicable to certain problems in ventilating a structure, one example being the odor diffusion from person to person in still air.

The author pointed out that in restaurants, for instance, a minimum air velocity of 200 fpm toward the kitchen had been found necessary to prevent escape of odors by diffusion into dining space. Tests by the author had not shown any variation in sensitivity of the human nose due to high or low humidity, or to high or low temperature.

Guide Committee Report

Chairman Tuve called on T. F. Rockwell, Pittsburgh, Pa., Chairman of the Guide Publication Committee who presented the report of his Committee which described the procedure of compiling the HEATING VENTILATING AIR CONDITIONING GUIDE 1947 and referred to the principal changes which were described in the preface.

He said that the Committee offered the following comments and recommendations:

The practice of having one-third of the Guide Publication Committee appointed each year had proved to be beneficial in preserving continuity of policy. This continuity makes it possible to plan for extended revisions which may require more time than is obtainable in any one year. Typical of this long range planning was the appointment during the past year of a committee which was requested to prepare a new chapter on Automatic Controls for submission to the next Guide Publication Committee. With the Director of Research serving as an ex-officio member of the Committee, information regarding the latest research work of the Society could be incorporated more readily.

It is recognized that occasionally information, which is of value to certain groups or individuals, is not continued in each edition of THE GUIDE because it may lack general interest. It is, therefore, suggested that an index might be prepared to indicate the last edition of THE GUIDE in which such information appeared.

In the preparation of this reference book for designing heating and ventilating systems the Committee is always faced with the problem of try-

[1]Studies on Odor Elimination in Apple Storage, by C. R. Gross and R. M. Smock. (*Refrigerating Engineering*, December, 1945).

ing to satisfy those who wish to have an over-simplified presentation which can be understood by the greatest number of readers and those who desire a more rigorous and scientific treatment of material included in THE GUIDE.

The Chairman thanked the Guide Publication Committee for the work done in preparing THE GUIDE 1947 and also for the suggestions for future committees which were contained in the report. He recommended that each member of the Society should consider himself a potential contributor to THE GUIDE.

Dehumidification

John Everetts, Jr., San Francisco, Calif., presented his paper **Dehumidification — Methods and Applications** (published in December 1946 JOURNAL SECTION, *Heating, Piping & Air Conditioning*).

MR. FLEISHER stated that, when the author and he were using lithium chloride rather successfully for dehumidification many years ago, they had also attempted to use diethylene glycol. While it was useful for dehumidification, they had discontinued its use because its toxicity was unknown and this was fortunate because it had later been found to be toxic. He stated that any glycol below triethylene glycol will produce the same dehumidification results, but will be dangerous because of toxicity. Also, under *humidifying* conditions the evaporation of diethylene glycol into the air would be 10 times as great as that from triethylene glycol. The difficulty in using glycols was due to the practical impossibility of removing droplets by means of eliminators and, hence, there was a tendency for the droplets to float in the air current and be deposited in various places in the system. Mr. Fleisher mentioned that some halides were dangerous, if used for dehumidification, due to the toxic carryover. Zinc chloride was one which had been tried but discontinued due to corrosiveness.

E. G. CARRIER, Boston, Mass., suggested that in some cases materials could be preserved equally well and more economically by addition of heat sufficient to keep the temperature of the material above the dewpoint, which in the United States would rarely be above 76 F. Many installations using heat instead of dehumidification for preservation of materials had been effective in many cases in New England.

H. M. HART, Chicago, Ill., inquired whether the costs shown in the paper included depreciation as well as operating costs.

B. R. SMALL, Pittsburgh, Pa., referred to the author's presentation of operating costs as a trail blazer. He noted that consideration had been given first to the use of straight refrigeration, then to simple adsorbents, and finally to a combination of both. In order to have 70 F effluent temperature, it was assumed that water cooling was used in the first stage and refrigeration applied in the second. Mr. Small stated that it was important to select properly dehumidifiers for specific applications.

He noted that the author used solid adsorbents instead of liquids in cost determinations and he asked also how the reactivation energy cost was figured. He suggested that consideration should be given to natural gas where available as a reactivation means. He pointed out that a steam pressure of about 100 psi would be required to obtain a reactivation temperature of 300 F when using steam, whereas this temperature could be obtained without pressure by use of gas. Natural gas at 36c per 1000 cu ft was suggested as being equivalent to steam at 30c per 1000 lb. The moisture added to the air by the combustion of gas would be approximately 4 grains per cubic foot burned.

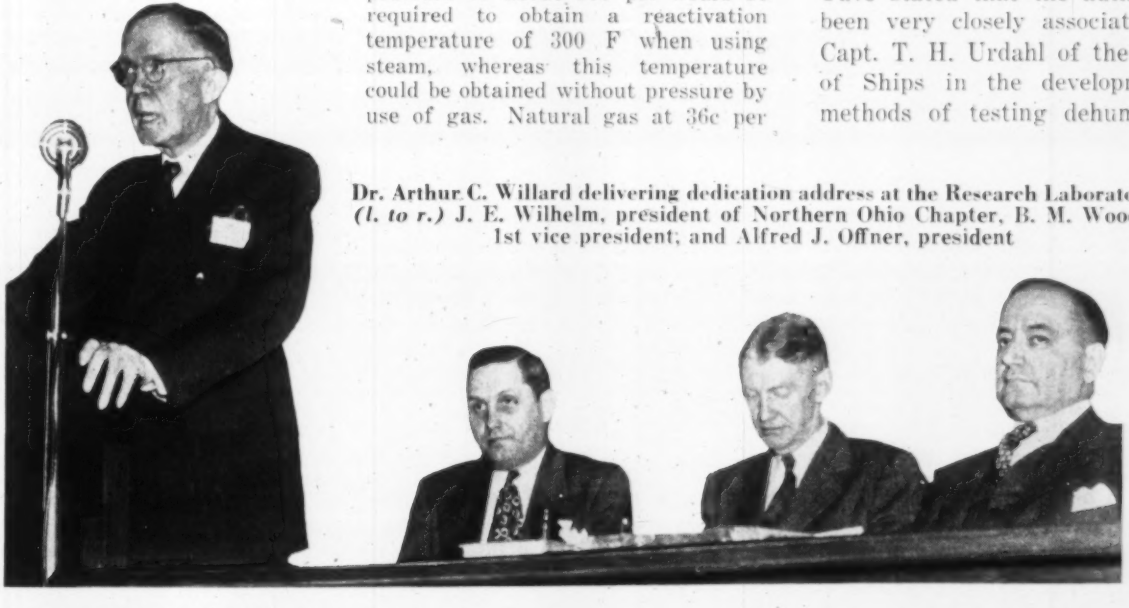
AUTHOR'S CLOSURE: Referring to Mr. Fleisher's remarks about corrosiveness of zinc chloride, the author remarked that it had destroyed the soles of his shoes during the tests.

The use of elevated temperature, as suggested by Mr. Carrier, could not be used in certain applications in which the material stored could not withstand the temperature required. An instance was cited in which a temperature of 112 F was required to maintain a relative humidity of 45 per cent.

The author, in reply to Mr. Hart's question, stated that costs given in the paper did not include depreciation.

Replying to Mr. Small's comments, the author stated that the costs of adsorbents were fairly well equalized. A value of 0.58 kw per pound of water removed had been found to be an approximate operating cost when using solid adsorbents. The author recognized the value of natural gas for reactivation and agreed that it would have advantages unless steam at 100 psi were already available at the installation.

In introducing Prof. E. R. Queer, State College, Pa., who presented the paper **Rating Dynamic Dehumidification Equipment,** which he prepared with E. R. McLaughlin, (published in January 1947 JOURNAL SECTION, *Heating, Piping & Air Conditioning*), Chairman Tuve stated that the authors had been very closely associated with Capt. T. H. Urdahl of the Bureau of Ships in the development of methods of testing dehumidifiers.



Dr. Arthur C. Willard delivering dedication address at the Research Laboratory *(l. to r.)* J. E. Wilhelm, president of Northern Ohio Chapter, B. M. Woods, 1st vice president, and Alfred J. Offner, president

T. H. URDAHL, Washington, D. C., congratulated the authors on the development of a practical means of testing dehumidification equipment. He stated that the method outlined had become the Navy's standard method of checking the performance of dehumidification machines upon delivery to the Navy. Performance to date had indicated that the machines would preserve the ships for at least 20 years.

P. J. MARSCHALL, North Chicago, Ill., remarked that dehumidification had very important applications in the pharmaceutical industry. He cited the case of one manufacturer who had 10 dehumidifying systems using both solid and liquid adsorbents and mentioned that in some cases relative humidities as low as 10 per cent were required.

He mentioned the importance of preventing contamination in any chemical type of humidifier if it were to continue to perform at its original rating.

AUTHOR'S CLOSURE: Professor Queer, in commenting upon Mr. Marschall's remarks, stated that attempts had been made in the laboratory to contaminate the desiccants. A large number of materials had been used, but none of the materials used had caused a change in the characteristics of the desiccant. In some of the Navy program tests, however, some difficulty had been caused by asphaltic materials which had caused deterioration of certain types of desiccants. The author believed that desiccants could be developed which would be practically free from contamination by the majority of materials.

Chairman Tuve thanked the authors for the papers presented.

The session was adjourned at 12:00 noon.

Panel and Radiant Heating Forum

2nd Vice President Tuve, Cleveland, called the meeting to order at 2:00 p. m., January 28, in the Ballroom of Hotel Statler, and announced that Prof. C. F. Kayan. New York, N. Y., would be Chairman of the forum on panel and radiant heating.

Professor Kayan referred to panel and radiant heating as a subject which seemed to have an interest comparable with that taken in the heat pump, the gas turbine, or rocket flight. He stated that the object of the present session was to bring out useful information and to clarify Society thinking on the subject of panel and radiant heating. Professor Kayan announced that for orderly consideration of the subject it had been planned that five divisions of the subject would be presented by five Society members, H. H. Angus, C. F. Boester, C.-E. A. Winslow, W. B. Morrison and R. L. Byers, and that following this presentation an opportunity would be offered the audience to ask questions and to participate in the discussion.

Is There a Difference Between Panel Heating and Radiant Heating? H. H. ANGUS, Toronto, Can.

We can best approach this subject by reviewing general data so as to bring out the salient points. The figures to be given are approximate only as many factors enter into them, but they are close enough for purposes of this discussion which refers to problems in our industry.

The normal rate of heat production in an average sized sedentary individual is around 400 Btuh. Of this 300 to 320 Btuh are given off by radiation and convection from the external body surface. In still air the radiation loss will be about 190 Btuh and the convection loss about 120 Btuh. If we have high velocity of air the loss by convection will be greatly increased and may go as high as 250 Btuh in which case comfort may be obtained with a radiation loss of 50 Btu.

The area of the body of an average individual is about 19½ sq ft for convection and 15½ sq ft for radiation as some sections of the body such as the legs radiate their heat to other portions.

The rate of heat loss by convection depends on the average temperature difference between the surface of the body and the surrounding air, also on the rate of air motion.

The rate of heat loss by radiation depends on the exposed surface of the body and upon the difference between the mean surface temperature of the body and the mean surface temperature of the surrounding walls, called the mean radiant temperature and abbreviated MRT.

The required rate of heat loss can result from a relatively low air temperature and a relatively high MRT as illustrated by a person standing in the sunshine on a fairly cold day. On the other hand the rate of heat loss can result from a relatively high air temperature and a relatively low MRT if, for instance, a person is in a warm room in line with the rays from a radiating surface.

In a conventional radiator type heating system the exposed radiators emit about half of their heat by radiation and half by convection. Convection units emit almost all of their heat by convection.

We should also remember that the intensity of heat radiation varies inversely as the square of the distance from the source of radiation.

The heat received from the rays of the sun is generally referred to as solar heating by engineers and will not be considered here.

In industry there are many examples of heating by radiation from high temperature surfaces, a drying oven being one example.

In open air schools and similar buildings the occupant is surrounded by outside air at relatively low temperature and is exposed to the heat rays from a high temperature surface. Such systems are in general use in many parts of Europe and are definite examples of radiant heating.

Our discussion today is to be limited to closed rooms in which the occupant is surrounded by walls, floor, and ceiling.

In conventional systems, heating is obtained by radiation and partly by convection. As we go a step farther and get more effect by radiation and less by convection we may consider whether a distinctive name should be given to the system.

In mild climates comfort is obtained if the occupant can be exposed to direct rays from a source of heat. In colder climates it is necessary to heat the walls or surrounding air to some extent. This can be illustrated by a person standing in the sun. Down to a certain temperature in still air he will be quite comfortable but below this temperature he will not be comfortable.

Our question then is whether we should refer to heating systems under two names or whether we should have one name to cover all heating systems of this type for systems used in our industry. A starting point may be the definitions given in THE GUIDE in which we note a distinction in the definitions as follows:

Panel Heating: A heating system in which heat is transmitted by both radiation and convection from panel surfaces to both air and surrounding surfaces.

Radiant Heating: A heating system in which only the heat radiated from panels is effective in providing the heating requirements. The term *radiant heating* is frequently used to include both panel and radiant heating.

What Heating Mediums for Panel and Radiant Heating Systems? C. F. BOESTER, Lafayette, Ind.

My remarks are predicated on the assumption that design conditions have been established requiring physical control of one or more surface

temperatures of an enclosed space. My remarks are also qualified that such controls are accomplished behind the surface or surfaces involved because you also can affect and control surface temperature by other more conventional means.

The popular mediums for panel heating at the present time are: heated air circulated through the spaces behind the surfaces involved; and heated water circulated through pipe coils in the walls, ceilings or floor surfaces.

There is also the means of controlling the surface temperature electrically by the use, for example, of a rubber film such as was seen on display at the Exposition. This is a compound material which has electrical resistance but a film coated on glass may be used. Likewise, it is possible to use a foil tape having resistance characteristics and place it behind the surfaces involved. Resistance heating as far as the panel surfaces are concerned is not too popular except in areas having favorable power rates.

Economically, as one experiment shows, the room enclosure should be low in thermal capacity. Then by placing the heating element in four or possibly all six surfaces, the enclosure may be brought instantaneously to design conditions by the control switch, after which the air thermostat becomes effective as air temperature builds up. It is possible to reduce the energy requirements materially by using heat only in the space being used.

There are several applications of the heat pump in which the hot refrigerant gas from the heat pump cycle is discharged to coils comprising the heat exchange surface.

Panel heating may also be accomplished by use of resistances located in the stud space. Air from the resistances in such a system moves upward within the wall and enters the room at the ceiling line and returns at the baseboard. It is also feasible to divide the stud space and have the warm air rise in one passage and return in the other.

There are several installations employing Perkins' tubes which are pipes placed vertically in the stud space and sealed at the end. A vacuum is drawn on the system and steam rises in the tubes. They are operated at steam temperature.

There are a number of installations in which pipe coils maintained at steam temperatures or at high temperatures by hot water are placed in the stud space. Intelligent use of insulation can materially affect the control of surface temperatures, and it would be recommended that perhaps two kinds of insulation be employed.

There are many problems involved in the mechanical installation of panel systems. Limitations of plaster drying is one of them. My personal experience is quite limited but I have had the opportunity of wide observation of work of others—the organization with which I am affiliated spending some $60,000 in the study of panel heating. Strictly as a personal opinion, I believe that we can get the greatest performance out of a ceiling installation; roughly one square foot of ceiling surface will do the work of two of the floor.

From the mechanical viewpoint and cost of the installation, the simplest installation would be the ceiling type. Small diameter tubing would be preferable on three or two and a half inch centers, depending on the design conditions. Proper headers should be developed to minimize pressure drop. A low volume of water would reduce the hazard of freezing. As a matter of fact small diameter tubing in some experiments was not damaged by freezing. No expansion tank is necessary on such a small system.

One advantage from a control viewpoint gained by use of small diameter tubing is that the fly-wheel effect is minimized and this aids in obtaining control. Also there will be lower first cost for the materials involved and lower installation labor costs.

I briefly tried to point out some of the mediums that might be involved in controlling surface temperatures.

JOURNAL SECTION

What Is the Comfort Temperature in Panel-Heated Rooms? C.-E. A. WINSLOW, New Haven, Conn.

The question I have been asked to discuss is not susceptible of any easy or uniform answer.

Comfort—under moderate or cool temperature conditions—is determined by air temperature and mean radiant temperature; and, with low air movement, the two factors are roughly of equal importance. The higher the air movement, the greater is the influence of air temperature while the influence of mean radiant temperature is unaffected. Therefore, the relative importance of air temperature is increased. In a panel-heated room, however, air movement should be minimal. If we assume that it is 20 fpm, or less (what we commonly call still air) we may take the operative temperature, which determines comfort, as approximately the mean of air temperature and mean radiant temperature. The formulas governing the relations between air temperature and mean radiant temperature have been worked out graphically by Bedford and Warner.[2]

[2]Bedford and Warner (nomograph), *Journal of Hygiene*, 34:458-473, 1934.

1948
HEATING AND AIR CONDITIONING EXPOSITION IN NEW YORK HEAVILY BOOKED

The enthusiastic response to the announcement that the 8th Heating, Ventilating and Air Conditioning Exposition would be held at Grand Central Palace, New York, February 2-6, 1948, attested to the excellence of the display recently concluded in Cleveland.

When the floor plans for this 8th Exposition were released, the immediate action by exhibitors brought reservations for 370 spaces, completely filling the first floor, second or mezzanine floor, and all but a limited portion of the third floor of Grand Central Palace.

This instantaneous response with the advance heavy reservation of space confirms the feeling of the Council of the ASHVE that progress and new developments in the industry are so rapid that there is a distinct need for the Exposition to be held concurrently with the Society's 54th Annual Meeting. It is also evident that the industry has confidence in the possibilities for the future and believes that the dissemination of information by means of the Exposition will be effective.

All classifications of equipment will be featured in the Exposition, which is the largest and most important event of its kind in the field of heating, ventilating and air conditioning. Like its predecessors, the Exposition will be arranged under the management of the International Exposition Co., of which Charles F. Roth is manager, and E. K. Stevens, associate manager.

The subject is complicated, of course, by the fact that, in practice, the mean radiant temperature of a panel-heated room is determined not only by the high temperature of the panelled walls but also by the low temperature of one or more cold exterior walls. What actually happens may be illustrated by these simple examples.

Let us assume a cubical room, with panels in floor and ceiling and with one outside wall whose mean surface temperature, including window surfaces is 55 F, which might occur with two good sized windows in cold weather. Assume also that the mean temperature of ceiling and floor surfaces is 75 F. The mean radiant temperature will then be 55 F (for outside wall) plus 2×75 F for the floor and ceiling plus 3×68 F for the three interior walls, divided by 6 or 68.2 F. To produce an operative temperature of 68 F, the air temperature should be 67.8 F.

If we assume a mean temperature of 80 F for the floor and ceiling, with outside conditions the same, the mean radiant temperature would be 55 F plus 2×80 F plus 3×68 F divided by 6 or 69.8 F; and the air temperature should be 66.2 F.

If the mean floor and ceiling temperature were 85 F the mean radiant temperature would be 71.5 F and the air temperature could be lowered to 64.5 F.

To take a more extreme condition—such as might occur in a corner classroom of a school with large window areas in cold weather—let us assume that two outside walls have a mean temperature of 55 F; and that the mean temperature of floor and ceiling is 85 F. Then the mean radiant temperature would be 2×55 F plus 2×68 F plus 2×85 F, or 69.3 F. The corresponding air temperature for comfort would be 66.7 F.

The point of practical importance is that the essential function of panel heating is to balance through warm walls the heat loss from cold walls. Under practical conditions, the spread between air temperature and mean radiant temperature cannot be very great, since the only way in which a high differential can be maintained is by artificially cooling air which we do in our experimental laboratories but which would be manifestly absurd in practice. Therefore, we cannot assume any practical condition in which air temperature will be more than 2-3 deg below the normal comfort temperature of 68 F.

Where radiant heating is not employed, however, it is clear that the air temperature must be above 68 F in order to balance cold walls and windows. With convection heating alone, the air and the two interior walls, and the floor and ceiling, under the last of the three conditions cited, would have to be 70.6 F to give an operative temperature of 68 F (2×55 F+10×70.6 F ÷ 12).

Finally we must bear in mind that the effect of radiant temperature depends on the angle of exposure of an individual to a given surface. The person sitting near a window will be much colder than a person sitting near a relatively warm wall. Differential distribution of radiant heat must be worked out to meet this situation; just as in convection heating the warm air may be supplied in approximation to the cold wall.

Does a Panel or Radiant Heating System Save Fuel? W. B. MORRISON, Portland, Ore.

In order to make the proper comparison between heating systems, all variable conditions in the buildings should be eliminated. An exaggerated example showing the effect of different conditions is obtained by comparison of two buildings both of 10,000 sq ft floor area, one building of a 100 ft x 100 ft size and one of a 20 ft x 500 ft size. A floor panel heating system in the square building of a 100 ft x 100 ft size would no doubt require less fuel than a conventional heating system; but a floor panel heating system in the long building of a 20 ft x 500 ft size might require more fuel than a conventional system. The reason for this is that the larger perimeter losses from the floor in the long building would require a disproportionate amount of fuel.

For the purpose of simplifying this introductory talk I will discuss first an average residence or small building with an area of approximately 1500 sq ft having low ceilings. Assuming a floor panel heating system in a small building of this type, we find that the increased ground losses add possibly 10 per cent to the computed heat loss unless extraordinary precautions are used. To offset this increased heat loss, we have the fuel saving which may be realized by the reduction of temperature within the building. The saving which may result from this reduction in temperature approximates the increased floor loss thereby resulting in very little advantage for the panel heating system. Let us now examine a ceiling panel or wall panel system with panels on exposed walls. We find that the increased heat losses from panel areas approximate 6 per cent of the total calculated heat loss. To offset the increased loss we, of course, have the reduction in temperature which might provide a saving of approximately 10 per cent. These figures indicate to me that there is not too much to be gained in fuel heating costs by the use of panel heating in an average house.

With regard to fuel cost in residences, I can't help but think of one client's reaction. He said, "I'm not building this house because it's cheaper than living in an apartment; I want a house so I can have an argument with my wife without everybody listening in, and, also, when we get up in the night I want warm feet and a warm house. Forget the cost—put it in!"

For commercial buildings I am basing my comparison on buildings with 10,000 sq ft or more of floor area with ceilings 24 ft or higher and the use of a floor panel heating system as compared to a conventional unit heater system. With a floor panel heating system the stratification of heat at the higher levels with its attendant increased heat loss is avoided. Also equal comfort conditions can usually be maintained with lower air temperature by using a panel system. An analysis would indicate that sizeable reductions in fuel costs may be realized in larger buildings using floor panel heating and maintaining comfort conditions equal to those with a conventional unit heater system.

In conclusion I wish to state that my observations have indicated that fuel savings to be realized by installing panel heating in residences or small commercial buildings are relatively minor; but that the installation of panel heating in large commercial buildings may provide substantial savings in fuel.

Control Requirements for Panel or Radiant Heating Systems: R. L. BYERS, Cleveland, Ohio.

The temperature control for radiant heating might be defined as the control of the heat flow into a building to maintain comfort.

Several factors, inherent in radiant heating systems, need consideration: (1) The time lag of the heating system or the time until the panel surface will respond to a desired change in Btu output; (2) The time lag of the structure or time until the inside temperature of a building will reflect a change in outside temperature; (3) Effect of solar heat; (4) Effect of wind.

The heat supplied to a building may be controlled by a room thermostat to maintain a certain inside temperature or by a device that will proportion the amount of heat supplied in relation to the outside temperature. A room thermostat may be used in conjunction with an outside controller to stop or reduce the flow of heat in the system, or to a zone or a room if overheating occurs. Solar heat, wind or internal heat gain may make this necessary.

These control systems may be used to modulate the temperature of the heating medium which is supplied continuously or they may be used to control the flow of a constant temperature heating medium. It seems necessary, therefore, that we must

analyze a building and its heating system, to determine the proper type of controls.

Let us now consider a few hypothetical cases:

A building constructed of sheet steel is to be heated by a heavy concrete floor slab. The building will respond very rapidly to a change in outside temperature or solar heat but the floor slab will respond very slowly and a wide fluctuation of inside temperature will result. This combination of short time lag of structure and a long time lag in heating system should be avoided if a good comfort condition is desired.

Consider a masonry building to be heated by a concrete floor. Here we have a structure and a system both having approximately the same time lag and both having a long time lag. An outside controller is indicated because the controller will sense the change in outside temperature and increase the heat flow. The flow will then respond in sufficient time to meet the requirements of the structure.

Consider a masonry building to be heated by a lath and plaster heating panel, a long-time lag on the structure and a short-time lag in the panels. An inside thermostat may be used because the panel response is much more rapid than the structure and will produce heat in time to prevent a wide fluctuation in room temperature. An outside controller on the other hand may cause a supply of heat to the room too soon and thereby cause over-heating.

We may, therefore, draw the following conclusions:

1. The time lag of the heating system should not be greater than the time lag of the structure.

2. If the time lag of the structure and time lag of the system are the same, an outside control might be indicated.

3. If the time lag of the system is short and the building long, an inside thermostat may be used satisfactorily.

Let us not permit our theory, however, to lead us into design of too complicated control systems. Systems must be kept simple in regard to installation, operation, and adjustment. In small systems controls must be simple so that an average layman may understand them and be able to make necessary adjustments. We do not want to use formulas, slide rules, or tables to adjust the equipment or find it necessary to call a man out of bed 15 miles away from the installation on a zero night to come and make an adjustment.

The cost of controls must bear some relationship to the cost of the system or the quality of the job.

If, for instance a five-room house is to sell for $10,000 in Cleveland, complete with lot, utilities, etc., the panel heating system cannot cost over $850. How can we install a temperature control system to cost $200 out of $850? Unless we can obtain control by means of a room thermostat and a limit switch, it will be impossible to build a house with a panel heating system.

Following the period of analyzing we have been going through, most of us are going to learn best by practical application and time will be our teacher.

Is There a Difference Between Panel Heating and Radiant Heating?[3] F. E. GIESECKE, New Braunfels, Tex.

Panel Heating had its origin in England about 1907, when Prof. A. H. Barker noticed that rooms whose walls contained flues leading up from fireplaces on the lower stories were much more comfortable than rooms whose walls did not contain such flues. Following this experience he conceived the idea of artificially heating the walls of a room so that their surfaces would radiate heat to the room. He was granted a patent on this new method of heating which he named *Panel Warming*, but as he was not commercially inclined he sold his patent to the firm of R. Crittall and Co., Ltd. This firm developed the discovery. The system was known first as the Crittall system of heating, and later as panel warming, or panel heating, or radiant heating.

Panel heating or radiant heating made fairly rapid progress in England, Switzerland, Germany, and other European countries, but progress in the United States was quite slow, partly because air conditioning was being developed by Mr. Carrier at that time and partly because a royalty was being demanded on the installation of the Crittall system of heating. However, during recent years much publicity has been given to panel heating or radiant heating in the United States and in Canada and it is possible that some persons have been led to believe that there is a fundamental difference between panel heating or radiant heating and the older methods of heating.

There is no fundamental difference between panel heating and radiator type of heating; in both systems the heat is delivered to the room partly by radiation and partly by air convection currents. The difference between the two systems is that in panel heating a larger proportion of the total heat delivered to the room is delivered by radiation than is the case in radiator heating.

The difference between panel heating and warm air heating is less than is generally assumed. In a warm-air heating system, heat is delivered to the room by air convection currents. The warm air rises to the ceiling and floats along the ceiling. If the ceiling is well insulated, the under surface of the ceiling will be only a few degrees cooler than the warm air in contact with it; the ceiling will then become the heating panel for the room and the system may be designated as a warm-air panel-heating system.

The principal contribution which the development of panel-heating has made to the science and art of heating and ventilating is that we now recognize and appreciate the important part which radiant energy has in the heating and cooling of buildings to a much greater extent than we did before. We realize now that every point of every surface radiates energy in all directions and that every room is completely filled with radiant energy moving in all directions with very high velocities and that we are continually immersed in and surrounded by radiant energy.

We realize also that panel heating systems do not heat the occupants of a room and that panel cooling systems do not cool them. Panel heating systems and panel cooling systems, when properly operated, produce satisfactory thermal conditions within the room; i. e., these systems produce the mean temperature of the air within the room and the mean temperature of the surfaces enclosing the room, and these together enable the occupants of the room to dissipate the heat produced by their metabolisms at the rate at which the heat is produced within their bodies.

A brief illustration, with approximate calculations, of the operation of heating panels and cooling panels may be of interest.

Assume a room 100 ft square and 20 ft high; the floor covered with ice, as in a skating rink; the ceiling surface temperature maintained at 100 F, and the walls having a mean interior surface temperature of 80 F.

The ceiling will be a heating surface; the floor will be a cooling surface; the four walls may be heating surfaces or cooling surfaces or neutral surfaces, depending on the relative temperatures of the floor and the ceiling.

The heated ceiling will radiate energy at the rate of 153 Btuh per square feet; 70 per cent will be intercepted by the floor and 30 per cent by the four walls. The ice-covered floor will radiate energy at the rate of 91 Btuh per square foot; 70 per cent will be intercepted by the ceiling and 30 per cent by the four walls.

The mean surface temperature of the floor and the four walls will be 53.3 F and the flow of heat from the ceiling to the room will be at the rate of 450,000 Btuh by radiation and at the rate of 645,000 Btuh by radiation and convection, combined.

The mean surface temperature of the ceiling and the four walls will be 91.1 F and the flow of heat from

[3]Written discussion read by Carl H. Flink, technical secretary.

the room to the ice-covered floor will be at the rate of 527,000 Btuh by radiation and at the rate of 750,000 Btuh by radiation and convection, combined.

Since the ice-covered floor takes more heat out of the room than the room receives from the heated ceiling, it follows that the four walls must be heating panels and that heat must flow through them from the outside at the rate 105,000 Btuh, or at the rate of 13 Btuh per square foot, in order that the mean interior wall surface temperature will remain at 80 F.

To check this calculation: the mean surface temperature of the floor, the ceiling and three walls is 69.5 F; the flow of heat from the wall to the room is, therefore, at the rate of 10.6 Btuh per square foot; this is 82 per cent of the total required flow of heat calculated and checks the former calculation satisfactorily.

The mean surface temperature of the floor, the ceiling, and the four walls will be 70 F and the mean air temperature will then probably be about 65 F. When a room is heated by means of panels, the mean air temperature within the room is generally a few degrees lower than the mean temperature of the surfaces enclosing the room.

Heating Mediums for Panel and Radiant Heating Systems?[4] S. R. LEWIS, Chicago, Ill.

I am as happy to contribute my ideas to the Forum as I am unhappy that I cannot be present at the Forum.

I have reached no conclusions about any of the methods of radiant heating.

1. I think that no engineer should reach a *conclusion* about anything except that he should conclude that it is unwise to reach a conclusion about engineering applications.

2. The earliest installations of radiant heating designed by myself did use warm air blown under masonry floor construction prior to 1924, as in the Wesleyan gymnasium at Bloomington, Ill., about 1915, and in the basements of several public school buildings in Columbus, Ohio. I employed warm air for radiant heating in the floors throughout the entire Jones Junior High School in Toledo, Ohio, about 1925. I would employ it today in any plant where the conditions were favorable.

3. I have under way at present the conversion of one of the first large general office buildings having but one principal floor in which steam pipes under the floor were installed in about 1938 for radiant heating. The steam pipes, even though supposed to be capable of operation at high temperature, caused so much complaint from too-hot spots that they were abandoned and had to be supplemented by indirect warm air delivered through conventional grilles. We will substitute relatively low temperature hot water in the former steam coils.

4. It is convenient and economical to employ hot water in overhead serpentine pipe coils in multistory buildings such as hospitals, of which we have had two large ones in successful operating experience.

5. We have designed, and found eminently satisfactory, underfloor hot water pipes in large assembly rooms such as places of worship.

6. We have had operating experience with about 30 residences, using overhead hot water pipes imbedded in the plaster, also with steel ceilings. In these we have used ferrous piping and copper tubing.

7. We have designed and expect to have installed a large residence plant using lead-sheathed low temperature electric heating cable imbedded in the plaster.

8. We have employed metal and plaster and even wood facing for hot water radiant heat panels in side walls as auxiliaries to floor and ceiling surfaces as in small bath rooms in residences.

9. I suggest that we have inherited a tolerance of radiant heat coming downward from the sun, and I submit that the unquestionable comfort and success in the plants that have the heat transmitters overhead might point to avoidance of the apparently unnecessary long-time education of the human animal to accept heat rising from underfoot.

10. Our bodily heating system uses a warm liquid in tubes, circulated mechanically. This heating system has been reasonably successful. There is no extended use of a warm gas such as steam or air as a heat carrier in the animal world. The liquid heat carrier seems to lend itself well to control and to durability.

I intend to continue advocating the use of heat transmission via large areas of comparatively low temperature.

R. K. BECKER, Evansville, Ind., remarked that publicity on panel heating had been complex and confusing. In his design work he had adopted an output value of 70 Btuh per square foot of panel surface.

E. H. LLOYD, Washington, D. C., asked what provision should be made for ventilation in radiant heating systems and also suggested that Mr. Boester enlarge upon his remarks about application and heating mediums.

DR. WINSLOW stated that air change requirements should be those given in the HEATING, VENTILATING, AIR CONDITIONING GUIDE and would normally be 10 cfm as a minimum. If not supplied by infiltration, then this quantity of air should be supplied mechanically.

MR. BOESTER expressed a preference for small size tubing in panels in order to reduce heat capacity.

C. F. MALLY, Detroit, Mich., mentioned that he had heated a Quonset hut used for school purposes by passing air through the floor construction and that the floor temperature was at a maximum of 86 F although usually not over 80 F average.

RALPH POOLE, London, England, stated that two Roman buildings left by Julius Caesar in St. Albans, England, were good examples of the first known radiant heating systems. He also stated that in industries requiring high humidity a large percentage of the radiant heat is absorbed by water vapor in the atmosphere. Spinning rooms are therefore operated at high temperatures to provide comfortable conditions for occupants working near relatively cool machines.

H. C. SHARP, St. Louis, asked whether equipment could be obtained for transmission of heat entirely by radiation.

MR. ANGUS stated that such equipment might be available but that all heating systems transmitted heat by a combination of both radiation and convection.

F. W. LEGLER, Minneapolis, pointed out that articles on radiant heating in popular magazines frequently contain exaggerated claims such as "unclothed subjects can be comfortable in 50 F air if the walls, ceiling, and floor are warm" and "operating costs are one-third less." He advocated

Viewing wind tunnel control board
***(l. to r.)* Carl H. Flink (New York), Leo F. Collins, J. N. Livermore and G. H. Tuttle (Detroit), and R. D. Madison (Buffalo)**

[4]Written discussion read by Carl H. Flink, technical secretary.

publication of correct information which might become available for magazines.

DR. WINSLOW remarked that it was a fact that unclothed subjects would be comfortable in 50 F air if the walls, ceiling, and floor were maintained at 110 F and that this had been demonstrated in tests at the Pierce Laboratory of Hygiene. No practical application could be made of such a combination. Such marked contrast of temperatures is obtainable only in a laboratory by extremely costly and artificial equipment. Dr. Winslow did not believe that there would be, theoretically, any savings due to panel heating except possibly in buildings having high ceilings, but, even for these, savings had not been definitely established.

MR. MORRISON in referring to the statements on fuel savings published by various magazines, stated that savings were usually due to improvement in building insulation, window construction, and control equipment applied in conjunction with the installation of panel heating and that these improvements rather than the type of system accounted for the savings reported.

ROBERT GREENE, La Porte, Ind., inquired whether it was necessary to add moisture to air in panel heated rooms and, if so, what the optimum humidity would be.

DR. WINSLOW stated that, within residence space at ordinary room temperature, humidity conditions were usually adequate and would be insignificant in physiological effect. Humidity is extremely important in industrial processes and under hot working conditions. Dr. Winslow remarked that, as brought out in recent work of Professor Rowley, the ASHVE Comfort Chart gives too much weight to the effect of relative humidity in the lower range of temperature.

H. M. HART, Chicago, asked how a panel system should be controlled if the lag in the floor panel were greater than that in the building structure. He remarked that in a residence having single glass windows and having concrete floor panels the lag in the panel would be greater than in the walls and, therefore, an outdoor anticipating type of thermostat would not be expected to maintain uniform house temperature.

J. E. HAINES, Minneapolis, stated that if a heavy floor panel is used in a frame structure a change in weather which would require a 10 per cent change in panel output might require 3 hr to overcome the lag of the panel, whereas the sun effect might cause a change in the building temperature within 10 min. It was therefore important that the thermal characteristics of the heating panels should be such that the lag in the panel would not be greater than that in the structure.

L. T. AVERY, Cleveland, pointed out that panel cooling was related to panel heating and should be given consideration. In buildings having a heat gain inside controls could operate readily to effect a change, even from heating to cooling, if a perforated cooled ceiling were used and if cooled air were delivered and distributed properly.

W. J. WADSWORTH, Cleveland, asked whether a panel heating system could be satisfactory if the panels had greater lag than the structure.

MR. BYERS replied that due to the different demands and expectations of individuals it was difficult to define satisfaction. Time and experience would provide the best answer.

W. L. FLEISHER, New York, remarked that panel heating came from Europe where all heating is completely inadequate. In rooms heated by pipes in the floor it would be extremely difficult to reduce temperatures at night. Opening of windows would reduce temperatures, but also cause an increase of heat loss from the system and increase the fuel bill. He stated that any type of heating is radiant heating if the differential in temperature between the individual and the walls is not great enough to produce discomfort.

MR. FLEISHER disagreed with Dr. Winslow on physiological effect of humidity. He stated that, while Dr. DuBois and others had concluded that humidity did not have a physiological effect upon themselves, he still believed that many people when brought into a dry environment in winter would have electric discharges and would feel relieved by an increase of humidity.

DR. WINSLOW remarked that, if panel heating is to succeed, it is important that heating panels should respond rapidly to changes in heat demand. He also suggested that panels should be designed and distributed so as to obtain more radiant heat near windows as compared with other parts of the room. He inquired whether designers customarily made provision for such distribution.

MR. POOLE, London, England, remarked that perhaps the uniformity of temperature which is desired by so many may not be as stimulating as a variation in temperature.

A. A. ENGELBACH, Washington, D. C., reported that observation of a few floor panel heating systems led him to believe that they provided more comfortable conditions than were obtained in circulated warm air systems. He also believed that floor panel design temperatures could be raised to 100 or 102 F in the southern part of the United States.

MR. MORRISON replied that he believed 85 F should be the maximum temperature used for floor panels.

PROF. S. KONZO, Urbana, Ill., referred to the regain of heat which takes place in a residence from the piping, flue connection, chimney, etc., pointed out that this heat is available for heating the structure and may account for the fact that heating installations operate at less than design temperature. This condition had been found in warm air and radiator systems as well as panel systems.

If mean radiant temperatures are to be calculated for exact design it would be logical to take into account the large regain of heat which takes place in a residence. Refinements in calculations should be accompanied by a complete heat balance for the building.

G. L. WIGGS, Montreal, Que., Canada, suggested that the ASHVE Comfort Chart should take into account the mean radiant temperature.

Referring to control of panel systems, he expressed the opinion that the panel heating system in the British Embassy in Washington, D. C., was still controlled manually due to difficulty of obtaining proper automatic control.

MR. WIGGS cited an installation in Canada in which panels in the floor of the first story of a two-story building and in the ceiling of the upper story produced a condition enabling occupants to work in comfort near the outer wall of the building, although the outer wall consisted almost entirely of window area 12½ ft high.

P. S. PARK, Pittsburgh, Pa., gave his experience with design of several hundred panel heating systems using floor panels consisting of concrete and pipe and reported that a room thermostat had been adequate for control of these systems and that there were no complaints of temperature lag.

He also stated that, in general, installation costs of ceiling panel installations were somewhat less than for floor panel installations.

MR. BOESTER pointed out that ceiling panels gave greater output because they could be operated at higher temperatures than floor panels. Also, he observed that more area is available for heating in the ceiling than would be obtained at the floor.

M. W. KEYES, Neenah, Wis., asked what would be the effect on the lag

of the walls if they were insulated. His own experience indicated that insulation would produce a lag in the walls just about equal to that of concrete panels.

A. R. CURTIS, Salt Lake City, inquired whether a combination of unit heaters with panel heating would be of advantage in an industrial building having a loading platform at which large doors were opened frequently.

MR. MORRISON replied that buildings having large doors which might be opened frequently were often equipped with unit heaters or forced air systems adjacent to the doors to prevent the inrush of cold air.

FERDINAND JEHLE, Indianapolis, Ind., asked whether the maximum comfortable floor temperature had been established by test.

DR. WINSLOW replied that, while he believed the temperature of a floor panel should not exceed 85 F, he did not have a quantity of real data to establish this fact definitely.

W. M. WALLACE, II, Durham, N. C., stated that he had found many installations of panel heating, particularly in rooms with high ceilings, where the computations of panel output and the heat loss of the room did not show agreement. Panel heating seemed to have an advantage in such high rooms.

MR. BOESTER remarked that Prof. F. B. Rowley at the University of Minnesota was planning to run tests in which the temperature of the walls and ceiling would be under definite control. He suggested therefore that perhaps this same equipment could be used to determine the effect of floor temperature on foot comfort.

D. L. MILLS, Rome, N. Y., suggested that the systems employing heat sources of comparatively small area but comparatively high intensity might be called radiant heating systems, while those employing large area surfaces at comparatively low intensity could be considered as panel heating systems.

P. S. MORTON, Lawrence, Mich., inquired about the effect of a thick rug on floor panel output.

MR. MORRISON reported that in his experience the effect of the rug was not exactly the same as an insulator due principally to the increase of radiating surface provided by the rug.

MR. BOESTER pointed out that the water temperature in the system could be changed enough to compensate for a reduction of heat output in a panel covered by a rug.

J. R. FELLOWS, Urbana, Ill., asked whether floor temperatures in basementless houses heated by ceiling panels compared favorably with those heated by forced convection systems.

MR. BOESTER replied that with adequate insulation above the ceiling panels and with insulated walls the floor temperature should be satisfactory.

GORDON HYMAN, St. Louis, suggested that the ideal system might be a combination of radiant panels and circulated warm air which would provide adequate heat with floor panels at 70 F temperature.

MR. BOESTER stated that theoretically such a split system would be better than a panel system, but that in a great many cases cost rather than comfort was the determining factor in selection of the heating system.

L. J. HARRINGTON, Portland, Ore., asked whether discoloration would be accelerated in ceilings in which the heating panels did not cover the entire surface.

MR. BOESTER stated that discoloration was due to several considerations such as paint quality, temperature, and air movement and was not necessarily due to the temperature of the panel surface.

Professor Kayan thanked all those who had taken part in the discussion which he believed had been quite instructive to the audience.

Vice Pres. G. L. Tuve then called upon Art Theobald, Beverly Hills, president of Southern California Chapter, who reported that Southern California Chapter had extended an official invitation to the Society to hold its summer meeting at the Hotel del Coronado which was located across the bay from San Diego, Calif. and that this invitation had been accepted for the dates June 1-4, 1947.

Mr. Theobald remarked that those attending the meeting would have an opportunity also to take part in the meeting of the *American Society of Refrigerating Engineers* from June 9-11 at Los Angeles.

The meeting adjourned at 5:15 p. m. after giving a rising vote of thanks to Messrs. Kayan, Angus, Boester, Winslow, Morrison, and Byers for the expert advice which they had provided during the meeting.

Physiological Factors in Public Health

1st Vice Pres. Baldwin M. Woods, Berkeley, Calif., called the meeting to order. In his opening remarks he referred to the past collaboration of the Society and the medical profession and with others having an interest in the problems of public health. It was, therefore, quite fitting, he said, that the session was to be devoted to a presentation of contributions by men working in the field of medicine and public health.

The first paper, **Human Tolerance to Heat,** was presented by the author, Willard F. Machle, M.D. (published in February 1947 JOURNAL SECTION, *Heating, Piping & Air Conditioning*).

Dr. C.-E. A. WINSLOW, New Haven, Conn., referred to the importance of rapid acclimatization of the human body when entering a new environment. He pointed out that the Society's comfort chart was based on individual sensitization in passing from one environment to another and that the conditions of comfort indicated by the chart would not hold, as shown by tests conducted by Prof. F. B. Rowley, if the subjects were permitted to remain within the space long enough to permit acclimatization to the new conditions.

The second point made by Dr. Winslow was that the human body, while possessing remarkable powers for making thermal adjustments, did not make such adjustments without some physiological cost. There was evidence that the additional sweating used by the body as the main mechanism for adaptation to a high temperature was accompanied by discomfort and, under certain conditions, a reduction in efficiency.

While men working under great pressure continued to work without a falling off in efficiency, he had found in work of New York State on ventilation that the amount of work actually performed was materially reduced in a warm condition.

DR. WINSLOW stated that the power of the body to cool itself depended on two factors—the capacity of the air to receive the moisture, and the capacity of the body to produce moisture. The first factor was the controlling one in a hot moist environment, while in hot dry air, as in a desert, the ability to produce moisture

was the limiting factor. According to experiments of Dr. Dill of Harvard University, an individual living and working in a hot dry climate had in a few weeks been able to double his rate of sweat production.

CHAIRMAN WOODS suggested that Dr. Machle's comments on the significance of shock effect as experienced by individuals upon exposure to changed environmental conditions would be interesting.

H. ESSIN, Cleveland, Ohio, inquired about the length of time per day during which the subjects worked in the experiments and also asked about the activities of the subjects outside of working hours.

R. C. EDWARDS, Paterson, N. J., inquired whether a uniform environment would produce optimum health or whether a combination of exercise and periodic fluctuation of environmental conditions would be of advantage.

AUTHOR'S CLOSURE: Dr. Machle expressed appreciation of the work of Dr. Winslow in determining normal limits and stated that his own work applied to the effect of higher levels of heat upon the individual. Acclimatization apparently took place at higher temperatures in summer and at lower temperatures in winter.

While the rate of sweating might increase in a hot environment, there are sometimes cases in which the rate might deteriorate in a hot environment either in a few hours or in some other period—even months. In people having heart disease or in the aged, the ability to sweat is decreased, but whether it is due to inability to produce sweat or inability to raise the temperature to stimulate the sweat glands is not known.

Referring to Dr. Woods comment on shock effect, the author stated that in certain cases sudden exposure to heat under a condition of hard work may cause collapse, or heart stoppage, or produce many other strange effects.

In reply to Mr. Essin, the author stated that subjects under test remained in tropical conditions as long as six weeks. Day temperatures were as high as 92 F (wet bulb) and night temperatures were lowered to 85 F (wet bulb) a condition which might be encountered in the tropics. Except for two 5-min periods each day, the subjects remained within the test enclosure.

Referring to Mr. Edwards' inquiry, Dr. Machle stated that theoretically the optimum conditions would be those in which the cooling capacity of the environment would vary directly with the heat produced by the individual. At night, therefore, optimum conditions would be those permitting heat loss from the body by radiation and convection, but requiring a minimum of evaporation. When working, the radiant heat loss from the skin to the surroundings should be increased to permit the same amount of cooling without increased stress on the circulation.

Extreme examples of the individual's attempt to adjust the heat loss to heat production are illustrated in the removal of clothing above the waist at times, even in the Arctic at 40 F below zero by individuals exercising strenuously.

Dr. F. F. Heyroth then presented his paper **Methods Used in Determining the Health Hazards Arising from the Inhalation of Various Chemicals** (published in January, 1947 JOURNAL SECTION, *Heating, Piping & Air Conditioning*).

ALLEN D. BRANDT, Bethlehem, Pa. (WRITTEN): Dr. Heyroth's paper brings much information to the attention of the ventilating and plant engineer which should prove of value to him. It should be of particular interest to those ventilating engineers who specialize in exhaust ventilation for industrial atmospheric sanitation.

The author was careful to point out that setting *maximum allowable concentrations* (MAC), as a rule, requires toxicological data obtained from the three avenues of investigation. This is a very important point and explains why the engineer sometimes must *grope in the dark*. He is called upon to design a ventilating system to control the dust, fume or gas liberated at a new operation or process, or at a renovated one where new materials are being used. If perchance he is told what is in the new material rather than handed some totally non-descriptive trade-name, he is fortunate indeed, for then he can get some idea of its harmfulness from publications and tables such as Dr. Heyroth describes. What the ventilating engineer desires and frequently needs, however, is concrete data on the maximum allowable concentration. Owing to the time and effort required to establish these concentrations, only relatively few have ever been established and the engineer must resort to *guestimates* on the basis of comparative chemistry and toxicology. These values, if based on animal experimentation only, may be erroneous, as the author states. Nevertheless any value, even if wrong, is better than no value at all to the engineer who must design the control measures. This is not nearly so important for those operations which can be enclosed or to which local exhaust can be applied effectively as it is for those operations in which general or dilution ventilation plays a significant role, as it does so frequently when dealing with volatile liquids.

There is considerable difference of opinion in the industrial hygiene field on this matter of estimating tentative safe limits for new chemicals on the basis of animal experimentation. Many toxicologists are opposed, and not without reason, to guessing at the safe limit for industrial workers from their animal research. They may be wrong and this might reflect discredit upon them. True though this may be, are they not in a much better position to make a guess than the engineer who has no information at all and who does not even have the advantage of a good chemical and toxicological training? The engineer does not want to make a guess, but if the toxicologist refuses to do so there is no *out* for him unless we are willing to see how dangerous a new chemical is by its effect upon the workers before control is provided. Certainly the engineer wants more MAC's, many more, but in lieu of

Three ASHVE past presidents
***(l. to r.)* Dr. A. C. Willard (Urbana, Ill.), C. V. Haynes (Portland, Me.), and Homer Addams (New York, N. Y.)**

such values which can be accumulated at only a very slow rate, he will be most thankful for any *guestimates* which the toxicologist may provide regarding the comparative harmfulness of the newer chemicals.

WILLARD MACHLE, M. D., New York, N. Y. (WRITTEN): The author has done an excellent task in defining what one searches for in toxicologic investigation and the means by which one seeks an answer. It is evident that the methods apply without regard to the route of absorption. It is important to remember the limitations inherent in the method employed. MAC is the sacred cow of toxicologic research and is too frequently assumed to be absolute in character, once it has been established. Nothing could be farther from the truth. Its interpretation is subject to the relevance of the data upon which it is based, upon analytical method employed, state of material in the air (compound, particle size), upon climate perhaps, and upon the attributes of the population which is exposed. In view of the difficulties of controlling the numerous variables, it is extremely doubtful if reasonable certainty of MAC can be achieved except by actual plant observation or human experiment upon a sufficient number of individuals to ensure adequate sampling. The author has emphasized the difficulties of field observation. These must, however, be faced and dealt with if the effects of the variables of absorption, distribution, partition, excretion, and response are to be evaluated with respect to the various attributes of industrial population.

Maximum Allowable Concentration

W. N. WITHERIDGE, Detroit, Mich. (WRITTEN): Dr. Heyroth's paper is the best written commentary on the subject that I have seen. It should be read carefully by industrial hygienists, ventilating engineers, safety engineers, industrial physicians, general medical practitioners, toxicologists, chemists, physiologists, and numerous other workers in industry, insurance, government, law, education, and professional consultation.

This paper gives me an opportunity to present a matter of definition and clarification that has disturbed me for some time. Most industrial hygienists are aware of the fact that some of the discrepancies in the *maximum allowable concentration* values used around the country are due to a misunderstanding of the function of MAC. Perhaps the engineer who designs industrial process ventilating equipment has been in a specially uncomfortable position in the midst of the confusion.

Unless a regulatory body or investigating agency is careful to specify the objective it desires by the use of a list of MAC's, or the objective it has the authority to demand, there will continue to be conflicts across state borders, and between members of cooperating professions.

There are, in my opinion, the following possible uses and interpretations of MAC's of air contaminants:

(1) *The average concentration for day-long exposure of industrial workers that may not be exceeded without danger of physiological or pathological harm.* Most industrial hygiene agencies have this interpretation in mind when they establish or recommend MAC's for their jurisdiction. Frequently, however, the deliberations on the subject overlook the fact that a MAC for health maintenance or accident prevention may bear little relation to the MAC for uninterrupted production. Management and the industrial ventilating engineer want to know the latter values but legislatures and common councils have not yet delegated to governmental agencies in times of peace the responsibility for maintaining efficient, economical, uninterrupted production. This is in the realm of management's competition for the labor and product markets. The right and duty of governmental investigating agencies to assure the community that industrial atmospheres are both safe and healthful is unquestioned by good management.

(2) *The average day-long concentration that can be maintained without causing widespread annoyance or excitement of the working force in the vicinity, resulting in turn in perpetual complaint, bickering, argument, threats of work stoppage, high labor turnover, wastefully long relief periods, and so forth.* Some will argue that such a concentration would be zero. Most of us are reasonable human beings, however, and a particularly offensive odor or irritant in our workplace that we might be able to overlook on occasion is nevertheless good cause for objection when it becomes a common occurrence. Good management is well aware that it cannot afford to suffer the economic loss caused by repeated or continuous atmospheric nuisance, and the ventilating engineer is often called in to improve the atmosphere around a process in cases where management cannot be cited for violation of law or ordinance.

Some nuisances are serious to an extent that the law can step in. Others are practically impossible to eliminate by legal action, and the services of ventilating engineers are engaged simply because management has the intelligence (plus the money) to do everything within reason to maintain a nearly contented working force. Although there is available exceedingly little information on the nuisance value of airborne substances used in industry, the ventilating engineer has discovered in many cases that he must stay far below the MAC for health, in order to preserve his good reputation. This item is important to ASHVE membership, because the reputable and informed engineer will be careful in some cases to refuse to participate in any venture where the degree of ventilation for which money is available is only that which will satisfy the sovereign laws of the state.

(3) *The average day-long concentration that can be maintained without producing gradual inebriation of the worker, reduction in their physiological reaction time, and consequent increase in the probability of accidents caused by impaired mental or muscular functioning.* These results are considered temporary for some volatile substances that have this effect and in those cases any attempt to show definite disability under provisions of workmen's compensation laws ordinarily would fail.

This concentration is important to management interested in protecting all employees against the unsafe acts of a few as well as safeguarding the exposed worker against accidental injury to himself. In this matter the employee is not always cooperative, because some volatile substances produce a pleasant level of slight intoxication sincerely appreciated by certain members of the working force. Employees have even objected to job transfer, change of solvent, or excessive ventilation because of the sudden termination of respiratory stimulation. A few intoxicants are successfully metabolized and eliminated from the body without serious effects, and therefore, apart from the temporary effects more or less desirable according to viewpoint, they cannot be charged with causing prolonged or compensable occupational disability. But, for the same reason that management does not want employees in the plant who are under the influence of ethyl alcohol, they likewise do not knowingly expose workers to conditions that would have the same physiological effect.

(4) *The momentary, five, or ten-minute maximum concentration that can be tolerated by industrial workers without danger to health, and which, if exceeded because of failure of approved mechanical controls, would require immediate cessation of the offending process.* The importance of knowledge of such a limit is that production engineers may discover that the risk of mechanical failure of certain equipment using highly dangerous substances would be too great to permit its introduction into their plant. This implies, of course, that a choice of process or material is available. When the product itself is hazardous, as in the atomic energy project, the production engineers must devise elaborate multiple safeguards against mechanical failures and accidents.

The quickly dangerous concentration of an air contaminant is also of concern when an air cleaning device is considered for the salvage or restoration of ventilation air, thus making it possible to return the air to the plant after removal of toxic impurities. In some cases it will be evident that recirculation through an air cleaner offers too great a risk.

(5) *The maximum concentration that could be maintained for a period of a few minutes without driving all workers from the vicinity due to intense eye irritation.* No informed agency would intentionally propose such a limit for industrial atmospheres, but they can do just that if overly preoccupied with the task of preventing demonstrable systemic disease. This critical air concentration must be known for more substances, because in certain cases the maximum allowable concentration for health maintenance is too close to the maximum allowable concentration for eye tolerance to be used in ventilation design. Engineers usually want anywhere from two to five as a safety factor below the concentration that will cause condemnation of their equipment.

(6) *The maximum concentration that can be maintained for a few minutes without driving all workers from the vicinity due to intense nasal or respiratory irritation.* Comments under item 5 also apply here. Maximum tolerance concentrations for the eyes and respiratory passages are not identical for most substances, and the designer or investigator of industrial atmosphere controls should know, if possible, which is the lower value.

Although some persons insist that any condition that is uncomfortable is also unhealthful, workmen's compensation for occupational diseases cannot be adjudicated with justice on the basis of widely divergent claims of discomfort, when all attempts to show impairment of health or disability have failed. A *comfort* limit, which good management will maintain if at all practicable, cannot at this point in history be stated as the limit that governmental health agencies have authority to enforce. If the citizens of a state or city decide to grant such authority to their health or labor department, they must be careful to make provision that evidence to the effect that air concentrations in a given space are not below the comfort limit, does not automatically constitute legal proof that the atmosphere is also one that will produce compensable occupational disease.

(7) *The maximum concentration that can be tolerated without nauseating normal or healthy workers by a foul or sickening odor.* This is certainly a matter of some consequence to industrial physicians, for any working condition that precipitates nausea is one that promptly should be terminated. Although nausea in itself would be classified as a symptom rather than a disease, it may well warn of the possibility af exposure to a disease-producing agent. It is therefore in the realm of health maintenance to require elimination of any atmospheric condition that persistently or repeatedly causes nausea, even though the victims recover completely soon after each incident of intermittent exposure. Frequent gastro-intestinal upsets are also a strain on physical stamina, and industry cannot afford to subject workers to such depreciation. If management or investigators do not recognize their responsibility in this type of problem in air contamination, organized complaint or high labor turnover are the usual results.

(8) *The maximum concentration that is permissible at any moment as a measure of fire or explosion prevention.* Because of the conventional procedure of separating governmental inspections of factories between the functions of health maintenance and accident prevention, it is essential for the peace of mind of plant managers, plant engineers, ventilating engineers, and workers as well, that the upper limits of gas or vapor concentration allowed by safety organizations for fire prevention be clearly understood as being generally unsafe for day-long inhalation. For very brief worker exposures, the maximum for fire prevention and health maintenance might be nearly the same. These facts must be understood by all parties concerned so that the public can effectively insist upon close coordination of the functions of industrial accident prevention and industrial health maintenance.

Experienced workers in industrial health, occupational hygiene, air sanitation, and industrial toxicology know very well that the foregoing itemized possible functions of MAC's (selected according to one's viewpoint or occupational assignment) do not coincide at one figure for any of the known industrial air contaminants. The fact that we already have so much apparent agreement around the country on a large number of substances is more surprising than the fact that many discrepancies also occur. A good deal of the agreement on MAC values, incidentally, is the frank result of the speed and ease with which we copy one another's data.

It is well known that many industrially-used substances have not been studied with all these criteria in mind. Most work has been done in physiological or toxicological laboratories to establish the relation between atmospheric concentrations and specific occupational diseases. It would certainly be helpful to the ventilating engineer if more studies were conducted on the sensory or perceptible responses to different concentrations of air contaminants, apart from any toxicologic considerations.

My objective in presenting this discussion is to suggest that whenever statements or tabulations of MAC's are made, written, or printed, that the editor, author, or compiling group clearly indicate the *kind* of maximum they are specifying; especially is this desirable when the values cited are not intended to cover all possible contingencies or objections. For example:

Maximum Allowable Concentration for Health

Maximum Allowable Concentration for Fire Safety

Maximum Allowable Concentration for Sobriety

Maximum Concentration for Eye Tolerance

Maximum Concentration for Olfactory Tolerance

Maximum Concentration for Respiratory Tolerance

The fact that many existing limits cannot be classified accurately according to such a scheme should be fair warning that they probably have no place in any compilation that is to be given the force of law. Those maximum limits which, by years of use and experience, are now known to give adequate but not luxurious or wasteful protection to health, life, and property, and at the same time avoid the usual difficulties caused by highly disagreeable sensory responses, are the values that *can* be given a place in legal standards if the citizens of the district so insist.

May I express my sincere thanks to Dr. Heyroth for presenting a subject to this Society in which I am deeply interested, and which I believe deserves the thoughtful study of our entire membership.

DEAN L. E. SEELEY, Durham, N. H., inquired whether the author had run any tests on combinations of gases, since it might be possible that, while neither gas would be present in quantity sufficient to cause injury, the presence of a combination might cause death.

H. ESSIN, Cleveland, Ohio, asked how the proper air flow rate to be used in experiments could be established since it was obvious that too high a flow rate would chill animals used in the tests and too slow a rate would not provide enough ventilation.

L. T. AVERY, Cleveland, Ohio, stated that the subject of industrial hygiene

JOURNAL SECTION

was the most important subject before the Society even though attendance at the meeting did not indicate that the members appreciated that fact. During the war it was industrial air conditioning in the factories that made possible the production of important items such as airplane starters, automatic pilots, and V-T fuses which were essential in protecting the lives of all. The subject should interest every tax payer because the cause of lost time, hospitalization, etc. is an industrial loss, the cost of which is born by all. Every member of the Society should be interested in industrial air conditioning because it affects him either directly or indirectly.

MR. AVERY stated that the large scope of the subject was recognized by the chairman of the Society's Research Technical Advisory Committee on Air Conditioning in Industry who already had stated that the subject was as big as the Society. As an evidence of industry's interest in the subject, Mr. Avery mentioned the appointment of Mr. Witheridge (Detroit) as ventilation consultant for General Motors Corp. and A. D. Brandt as industrial hygiene engineer for the Bethlehem Steel Co. He suggested the organization of the TAC on Air Conditioning in Industry into sub-committees, each handling subjects of limited interest in order to insure enough progress to be made to enable each sub-committee to prepare frequent reports to the Society.

AUTHOR'S CLOSURE: Dr. Heyroth stated that there was some difference of opinion regarding MAC of air contaminations and that this was due largely to the fact that consideration had been given to the subject during only the last 13 years. He recognized the importance of having field observations as well as experiments upon human beings as a basis for determining limits.

Replying to Dean Seeley's question,

Winston-Salem members R. B. Crosland *(left)* and DeParx Stimson *(right)*

the author stated that combinations of gases may behave quite differently than would be supposed from the effects of individual gases. In pharmacology much work is done on the synergism of drugs, that is the way two of them having somewhat similar activities might act if combined. There also are antagonisms which might be established between materials but since determination of the effects of combinations is rather complicated, it is preferable to deal with them separately unless in a particular industrial problem there is an exposure involving two materials simultaneously.

Referring to Mr. Essin's inquiry, the author stated that after a flow rate had been selected it was customary to run an experiment at the selected flow rate with uncontaminated air through a parallel group of animals in order to ascertain that the air flow rate and temperature condition did not produce any effect.

Replenishment Air for Living Spaces

The paper, **Minimal Replenishment Air Required for Living Spaces,** by W. V. Consolazio and L. J. Pecora, (published in the March 1947 JOURNAL SECTION, *Heating, Piping & Air Conditioning*), due to the absence of the authors, was presented by Dr. A. R. Behnke, who has a wide experience in determining the effect of environment upon men in submarines, airplanes, and other enclosures. Chairman Woods introduced Dr. Behnke, and referred to his past cooperation with the Society and his contributions to Society publications as an author.

After presentation of the paper, Chairman Woods remarked that the conclusion of comparability of carbon dioxide and odors was interesting. He then invited discussion of the paper.

W. D. TURNER,[5] New York, N. Y. (WRITTEN): The authors are to be congratulated on their contribution of a fund of new data in the specialized field of ventilation dealing with odor control. This paper represents a scientific approach to a most difficult problem. The authors have produced new ideas in the matter of odor effects in living spaces, odor measurement, and odor removal.

Since we have been engaged for a number of years in intensive basic research in the field of odor counteraction, we were particularly interested in the comments in this paper concerning a liquid deodorant. Obviously including this product in their comprehensive consideration, the authors state that "these substances do not control or oxidize odoriferous substances." It is not claimed that it controls or oxidizes odoriferous substances, whether malodorous or otherwise. Our explanation is that when the odor of this product is diffused into the air, it so opposes other odors present that the human nose experiences an effect of neutralization of both odors.

This principle of odor neutralization was established by the work of Zwaardemaker and others, and is mentioned in standard textbooks[6]. Examples of specific pairs of odors which neutralize each other in this way are bitter almond and musk, rubber and cedarwood, and camphor and eau de cologne, and iodoform and Peruvian balsam. We have checked this neutralizing principle over a period of years on an extensive series of odors and have determined that it is applicable with significant results in the case of ordinary occupancy odors. The application of this principle in reducing odor intensity is in definite contrast with the use of a strong odor to mask other odors, or the application of a principle of fatiguing or anaesthetizing the olfactory senses.

The formulation of this liquid includes a low concentration of the complex extracted from the green plant cell, commercially produced and marketed as chlorophyll, together with a number of other components having characteristics which, when diffused into space, suggest a note of outdoor freshness. The effect of these substances is to give to air in living spaces an odor of low intensity which is more acceptable to the human breathing apparatus and which is suggestive in some degree of the odor quality of air in the country.

That Dr. Consolazio recognizes the principle of odor counteraction as developed to commercial availability in the liquid tested, is evident from a statement made in a private conversation with the writer. He stated that he had advised the naval authorities for whom his research work was carried out that there were three ways to control the odor in ships' berthing compartments, namely:

1. By new air only, requiring [illegible] per capita.
2. By partial recirculation through silica gel or carbon.
3. By use of odor counteractant such as the one he tested.

It is most significant that Dr. Consolazio's conception of human odor perception in occupied spaces is in contrast to the Weber-Fechner law of physiological reaction, namely that sensation is proportional to the log of stimulus. As is pointed out in the paper under discussion, human occupied spaces usually involve more than one type of odor at a time. From this the authors conclude that the well established Weber-Fechner law is inoperative in determining human acceptability of odors in occupied spaces. This questioning of this law has such important implications that further research should be conducted to determine the validity of the law when so applied.

The paper describes a chemical method for the determination of odoriferous substances which is based on the effect of these substances on an acid permanganate solution. This test might be of some aid in establishing the day-by-day values of substances reducing the solution, provided no variables were introduced. This handicap is well recognized by the authors throughout their paper. It would be difficult, however, to demonstrate any direct correlation between odor level and permanganate reduced, since permanganate may be definitely affected by air of minimal odor value, or may be scarcely affected by air carrying a stench.

When this liquid is introduced into the air, a number of its constituents will themselves modify the acid permanganate solution. Hence, it might be erroneously inferred from the results of the permanganate tests that the introduction of the liquid resulted in the presence of increased amounts of malodorous substances. Therefore, this test cannot have validity in appraising the value of liquid odor counteractants such as we have described.

The foregoing comments on this paper concern only those phases of their work relative to the liquid deodorant as a liquid odor counteractant for living spaces. We repeat our earlier statement that the contribution of these authors is important in respect to a number of objectives within the study. It points up the difficulties that attend all effort connected with odor appraisals and emphasizes the need for continuing research in this important aspect of control of air conditions in occupied spaces.

C. S. LEOPOLD, Philadelphia, inquired whether a log of the number of people smoking was kept during the tests. From some personal observations made in Madison Square Garden, New York City, he concluded that less than 16 per cent of the per-

[5] Florida Chemical Research, Inc., New York, N. Y.

[6] Physiological Basis of Medical Practice, by Best & Taylor (2nd Edition, p. 1720). The Chemical Senses, by Moncrief.

sons in attendance smoke at one time.

DEAN SEELEY asked whether the metabolism of the subjects decreased when the air supply was 1 cfm per occupant.

DR. MACHLE inquired whether there was a correlation between the amount of reducing material and the air.

W. E. ZIEBER, York, Pa., stated that, owing to the difficulty of obtaining a group of men under control for experiments in an industrial organization, his company had been trying to evaluate the effect of tobacco smoke by burning fixed quantities of tobacco and determining the value of various materials for absorbing or reducing the tobacco smoke.

He stated that the odor of tobacco smoke becomes very rancid when the visible smoke is removed. A precipitation occurs almost immediately after production of smoke and there is immediately some disappearance of the visible smoke. Odor reactions will therefore be quite different at a distance from the source of production than when obtained close to the source. In experiments Mr. Zieber used permanganate as a reducing agent.

MR. ZIEBER also inquired about the type of coating used on the coils, since he had found that a copper surface seemed to collect more deposit than a coated surface. He also asked what method was used to determine the quantity of ozone present in the air.

L. S. RIES, Oberlin, Ohio, asked whether there was a correlation between the moisture content of the air and the odor removal.

G. A. POST, Indianapolis, Ind., inquired whether there was a difference between smokers and non-smokers in ability to differentiate between odors.

MR. CONSOLAZIO, having had an opportunity to review the remarks of the various commentators, has supplied the following written comments:

Conquer Odors — Three Ways

W. V. CONSOLAZIO (WRITTEN): My comments to Dr. Turner are as follows: "I am conscious of the publications relative to odor neutralization. However, I am not in agreement with the conclusions drawn from the point of view of commercial application. That my own opinions on odor control as forwarded to the cognizant naval authorities are as follows: 'There are three mechanisms by which odor control may be instituted in berthing spaces, the factors to be considered in making the choice of methods are economics and attitude.'

"The mechanics of odor control are as follows: (*a*) The maintenance of sufficient quantities of replenishment air, for the conditions as they now exist in the non-air conditioned berthing spaces—50 to 60 cfm per man; for projected air conditioned spaces —5 cfm per man. (*b*) By use of carbon sorption as now developed or silica gel if and when it is demonstrated to be practical. (*c*) By use of odor masking agents. In this case the statement was qualified to take into consideration the aesthetic and economic attitudes.

"If it is decided that it is considered uneconomical to install means of *removal* of the odor and that odor masking will suffice, then I see no need for the purchase of a proprietary item when the same masking may be accomplished by spraying the environment with any pleasant smelling essential oil. Furthermore, should I own a theater or assembly hall and an odor problem confronted me, the simplest method of tackling such a problem, *if masking were my aim*, would be to allow the patrons to smoke—in this way I would correct the odor problem from the patron's point of view and at the same time create an atmosphere of sociability and welcome for the patrons."

AUTHOR'S CLOSURE: Referring to Mr. Leopold's inquiry, the author stated that the average consumption of cigarettes was 20 per man per day, being highest at about noon and fairly constant until early evening when it fell off. Odor impressions and analysis by permanganate method were lower in morning periods and higher in the afternoon. No attempt was made to obtain a more specific survey. The introduction of air at 1 cfm per man and increase of replenishment air from 1 cfm to 5 cfm removed the cause of eye irritation and smoke, and cleared the air.

Replying to Dean Seeley the author states that metabolism decreased as the subjects became accustomed to the procedure and became somewhat bored during the progress of the tests. Metabolism had varied as much as 50 per cent during certain periods of the day for early and late experiments.

Answering Dr. Machle's question, the author states that a correlation could be found between reducing substances in air and the amount of tobacco smoke, but not between odor level if comprising odors from the body, furnishings, tobacco, etc. The lack of correlation is due to the finding that degree of odor as measured by the individual is not quantitative. While a slight quantity of butyric acid is offensive, a large quantity of vanilin or tobacco is acceptable. This fundamental concept must always be considered in analytical studies of odoriferous substances.

Referring to Mr. Zieber's comments the author states that the coils were constructed of tinned copper tubes having tinned copper fins. A trisodium phosphate spray was used to wash the coil surfaces. The effect on condensation of odoriferous substances was not known.

The ozone quantity was not checked but was provided in accordance with manufacturers' instructions for operation of equipment used.

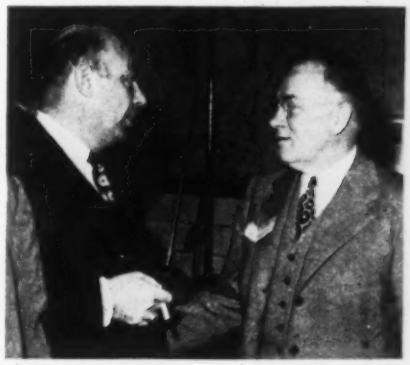
The author believes that a definite correlation can be found between quantity of tobacco burned and reduction of permanganate. Since permanganate does not oxidize all organic compounds to CO_2 and H_2O and since condensation of tobacco smoke and products occurs almost immediately, the factor of distance from the source and the time lag from consumption of tobacco to making of the analysis would certainly influence results obtained.

With regard to question of Mr. Ries on effect of humidity on odor level, the author finds that while odor levels, recorded by the same judges, were higher in summer than in winter it was not known whether the difference was due to a difference in humidity.

In reply to the question of Mr. Post concerning relative odor sensitivity of smokers and non-smokers, the author states that the subjects used were from a professional group and as a group were probably more sensitive than average. Fifty per cent were about average, 25 per cent were extremely sensitive and 25 per cent were of the tolerant type.

Until it is known whether design conditions are established for the sensitive or for the tolerant individual it is necessary to use the average although it may be advantageous to separate the test results of the sensitive and less sensitive groups.

***(l. to r.)* T. H. Urdahl (Washington, D. C.) and E. N. McDonnell (Chicago)**



DR. WOODS made the concluding remark that he looked forward to an increased appreciation on the part of the Society of the necessity of collaborating with medical men and to the development of a group or groups within the Society which would be competent to speak for the engineering point of view on industrial air conditioning problems.

The meeting was adjourned at 12:10 p. m.

Control of Panel Heating Systems

Pres. Alfred J. Offner, New York, N. Y., called the meeting to order at 9:30 a. m. in the Euclid Ballroom of the Hotel Statler. He presented Prof. F. W. Hutchinson, Lafayette, Ind., who gave an abstract of his paper **Response and Lag in the Control of Panel Heating Systems** (published in February 1947 JOURNAL SECTION, *Heating, Piping & Air Conditioning*).

F. W. CHAMBERS, Toronto, Canada, inquired whether the controls operated equally well with either inside or outside wall panels.

PROFESSOR HUTCHINSON stated that in this project the most effective control was obtained by the simple room thermostat; almost equally good control was obtained by means of the outside control compensated by room thermostat; and relatively poor control was obtained by the outside temperature compensation alone. No data were taken for the purpose of establishing heat loss from the structure.

A. A. ENGELBACH, Washington, D. C., inquired whether the sun load was determined and also wanted to know at what depth the coils were located in the concrete.

The author replied that no data were taken on sun load. The outside controller and inside thermostat were located in the shade. The roof was sloped so that the sun's rays struck it at normal intensity during the tests and this caused an unusual solar load.

The coils were embedded two inches in the concrete floor on top of which was laid a ⅛ in. thick parquet floor.

MR. RICHARDS, Pittsburgh, Pa., asked if there was any significance in the fact that the difference between the room temperature and the panel temperature increased as shown in Fig. 12.

PROFESSOR HUTCHINSON suggested that since the panel temperature increased with the load and since panel temperature indicates mean radiant temperature, it follows that the air temperature should decrease. He asked Dr. C.-E. A. Winslow, New Haven, Conn., to comment on this fact.

DR. WINSLOW stated that falling air temperature with increase of panel temperature would indicate more desirable conditions than if the panel temperature rose and the air temperature remained constant.

PROFESSOR HUTCHINSON remarked that the rise in room temperature observed in Fig. 12 was due to the effect of the sun which added heat and caused the controls to be ineffective at the end of the tests.

GENERAL DANIELSON, Memphis, Tenn., asked whether the concrete was laid directly on the ground and remarked that this would affect heat storage. He also asked if the floor temperature rose when the ceiling panels were used for heating.

PROFESSOR HUTCHINSON stated that the ceiling panels caused some rise in temperature of the floor panels.

C. F. BOESTER, Lafayette, Ind., answering the question, stated that the concrete wall footings extended downward 40 in.; 8 in. of vermiculite concrete were then laid on top of the soil; the coils were then laid on this base and covered by 2 in. of regular concrete and ⅛ in. parquet floor.

GENERAL DANIELSON asked if thermocouples were located under the floor, and why regular concrete was not used in the floor base.

PROFESSOR HUTCHINSON replied that many thermocouples had been placed between the floor and the ground but had failed to operate because of defective wire.

MR. BOESTER replied that the house was originally constructed for testing of the particular floor material which was used and that this floor was unchanged when the tests on control of panel heating systems were conducted.

W. L. MCGRATH, Syracuse, N. Y questioned whether the best possible use had been made of the on-and-off thermostat. He pointed out that cycles of operation, which in the test were of one to 1½ hours duration, could have been reduced by equipping the thermostats with auxiliary internal heaters. Mr. McGrath also suggested that the modulating type of thermostat could be used to depress the room air temperature as the load increased.

FERDINAND JEHLE, Indianapolis, Ind., stated that it appeared unnecessary to use a temperature control bulb in the water supply line. It would seem satisfactory to operate the control valve directly by means of the thermostat. He also remarked that if five rooms instead of one had been used in the test, the thermostat could have been located to maintain proper temperature in one room, but then the temperatures of the other rooms would have varied, depending upon the effect of sunshine and other factors.

PROFESSOR HUTCHINSON stated that the controls were selected originally in anticipation of severe control requirements with the thought that they could be simplified after a study of the operation of the various controls. It seemed possible that simpler controls would have been satisfactory. The author explained that while tests of the entire house were contemplated, the first tests were conducted in one room in order that a definite ventilation rate obtained by means of a mechanical ventilation system could be used.

R. G. VANDERWEIL,[7] Waterbury, Conn., expressed the opinion that room temperature might be a criterion of comfort for all practical purposes and, if so, a room thermostat might be used for satisfactory control of panel heating systems. He also inquired about the relative inertia of floor and ceiling panels and suggested that the author should have included information on the mean radiant temperature as well as the air temperature.

PROFESSOR HUTCHINSON stated that the investigation was not concerned with comfort and therefore the mean radiant temperature and panel temperature were not of significance.

The author also stated that as the load increases when the outside temperature decreases, the panel temperature must increase and the outside wall temperature decrease. The mean radiant temperature then may increase or decrease. It is obvious that as outside temperature decreases the air introduced by infiltration decreases in temperature and therefore requires more heat in being raised to room temperature. This ventilation load has very little effect on the exterior wall temperature, which, however, does affect the panel temperature. In a room having completely insulated walls so that there could be no heat loss through the exterior walls, the panel temperature would rise with increase of air change.

In the house used for test purposes the heat transmission coefficient had not been of interest and was not de-

[7]Project engr., development dept., Chase Brass & Copper Co.

termined. Also, the experiment was not made with any reference to the cost of controls, but rather with regard to performance.

The author gave one illustration of the cooling effect of walls having a high inertia by referring to a Mexican night club located in a cave. Patrons of the club sit in comfort in air temperatures of 87 or 88 F due to the cooling effect of the heavy walls.

PROFESSOR HUTCHINSON also stated that the combined inertia of the house construction and of the panel affect the inertia of the system and therefore the inertia of the panel should not be considered alone.

W. BRUCE MORRISON, Portland, Ore., asked whether the thermostat used was of the heat anticipating type and the author stated that it was not.

R. D. WATT, Seattle, Wash., asked four questions: Were the thermostats of standard commercial type? Were they shielded? How were they located, and were any experiments conducted with thermostats located within the outside walls?

The author stated in reply that: the thermostats were of standard types but were not identified by name plates; shields were used to reduce the effect of solar radiation; thermostats were located 5 ft above the floor; no thermostats were located within the outside walls.

MR. JEHLE remarked that it was a dangerous practice to leave the interpretation of charts showing test results to the so-called "*practical*" man, who might readily misinterpret them.

AUTHOR'S CLOSURE: Professor Hutchinson, in closing the discussion, stated that, while remarks, questions, and answers in the meeting had been limited to those coming within the field of the investigation reported in the paper, he nevertheless would be pleased to discuss personally with anyone interested any previous tests applying to panel heating systems.

Resolutions and Installation of Officers

G. D. Winans, Detroit, Mich., presented the following report of the Resolutions Committee and moved the adoption of the report, which was then adopted by unanimous vote:

WHEREAS, Alfred J. Offner has served on many Society committees as member and chairman, has served on the Council since 1935 to the present time, was Treasurer from 1935 to 1938, was Second Vice President in 1944, First Vice President in 1945, and has been President of the Society in the year just ended,

WHEREAS, His continuous and able application to Society duties has been outstanding and has contributed to maintaining the high standards set by previous officers,

BE IT RESOLVED, That the ASHVE extends its grateful thanks and appreciation to him and to the gracious Mrs. Offner who accompanied him on many of his travels to Annual Meetings, Semi-Annual and Local Chapter Meetings.

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WHEREAS, The health of L. P. Saunders, Chairman of Committee on Research, has not permitted him to be present at this meeting, and

WHEREAS, His efforts on behalf of the Society's Research Program and the Society's welfare, have been great and untiring, therefore

BE IT RESOLVED, that the ASHVE thanks Mr. Saunders for his many contributions and wishes his speedy recovery.

•

WHEREAS, the 53rd Annual Meeting of the Society has been an exceptional success due to the efforts of the Northern Ohio Chapter through its Committee on Arrangements under the able leadership of D. L. Taze, and

•

WHEREAS, many organizations and individuals have participated in providing members and guests with opportunities for instruction and entertainment, therefore,

BE IT RESOLVED, That an expression of appreciation be adopted and that copies be sent to each of the following:

To D. L. Taze, Chairman of the Committee on Arrangements and to his several committee members and their ladies.

To Dr. A. C. Willard for his address at the dedication of the Research Laboratory.

To the authors of the technical papers.

To Prof. C. F. Kayan and his panel in discussing panel or radiant heating.

•

To L. T. Avery, toastmaster of the banquet.

To C. F. Roth and his staff for the splendid 7th International Heating and Ventilating Exposition held concurrently with our meetings.

To Dr. Kirtley Mather for his address at the annual banquet.

To the Cleveland hotels for their cooperation in a difficult situation and to Hotel Statler for an excellent banquet.

To the newspapers and trade papers for their coverage of this annual meeting.

To the Chapters and individual members who have contributed so generously toward the retirement of the mortgage on the Research Laboratory.

Respectfully submitted,
G. D. Winans, *Chairman*
W. Bruce Morrison
C. Rollins Gardner

President Offner announced that the next order of business would be the installation of the Society officers for the year 1947 and requested that Past President W. T. Jones, Boston, act as chairman of the meeting.

Chairman Jones, speaking for the Society, thanked President Offner for his faithful service during the past year as president, in which position he had received the greatest honor awarded to anyone in the field of heating, ventilating, and air conditioning. Mr. Jones expressed the hope that Mr. Offner would enjoy a very happy experience as junior past president while serving on the Advisory Council. Mr. Offner expressed his great pleasure at having had the pleasure of serving the Society and paid tribute to the work of the other officers and Council for the work done during the year.

Chairman Jones requested Past President M. F. Blankin, Philadelphia, Pa., to act as marshal of the occasion and to assemble the following retiring members of the Council before the rostrum: C. M. Ashley, Syracuse, N. Y., L. T. Avery, Cleveland, Ohio, L. E. Seeley, Durham, N. H., G. D. Winans, Detroit, Mich., and C.-E. A. Winslow, New Haven, Conn.

Chairman Jones stated that it was fitting that he should express the appreciation of the Society for the years of service which the retiring Council members had given so unselfishly to the Society. He expressed the hope that their active interest in Society affairs would continue.

Past President Blankin assembled all of the past presidents present at the meeting and requested them to act as an escort for the newly elected officers in their approach to the rostrum. The following officers were then conducted to the rostrum and installed by Mr. Jones assisted by Dr. A. C. Willard, Prof. G. L. Larson, W. H. Driscoll, E. H. Gurney: Dr. Baldwin M. Woods, Berkeley, Calif.; Prof. G. L. Tuve, Cleveland, Ohio; A. E. Stacey, Jr., Syracuse, N. Y.; John F. Collins, Jr., Pittsburgh; M. W. Bishop, Milwaukee, Wis.; C. F. Boester, Lafayette, Ind.; Leo Hungerford, Los Angeles, Calif.; R. F. Taylor, Houston, Tex.; and E. N. McDonnell, Chicago.

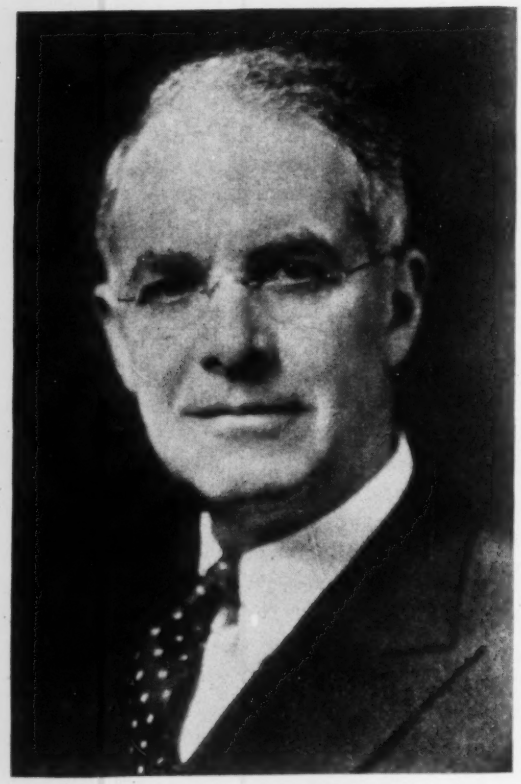
Chairman Jones then requested all Council members to join the officers on the rostrum, after which he handed the gavel to President Woods.

OFFICERS FOR 1947

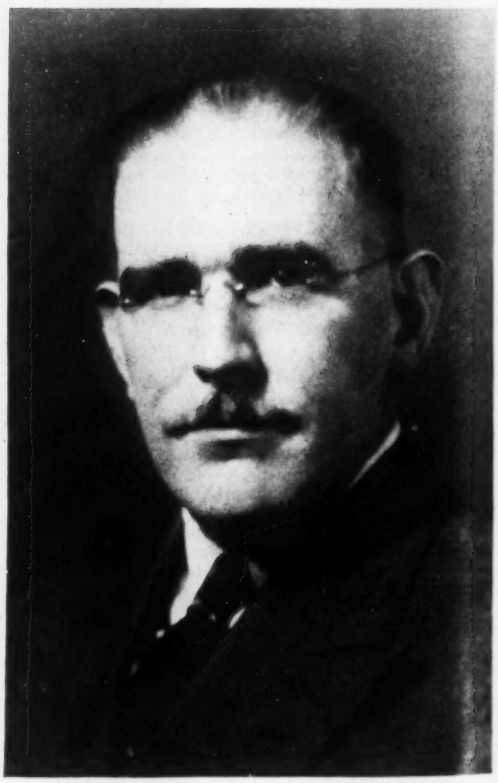
A · S · H · V · E

Baldwin M. Woods
Berkeley, Calif.
President

G. L. Tuve
Cleveland, Ohio
First Vice President



A. E. Stacey Jr.
Syracuse, N. Y.
Second Vice President



John F. Collins Jr.
Pittsburgh, Pa.
Treasurer

President Woods stated that the past year had been one of great cooperation and that he had enjoyed his service with retiring President Offner. He expected that the Society growth, which had been the largest in its history during the past year, would continue. In order to make size contribute to greatness and to preserve the purposes of the Society, he regarded it of particular importance to present to the general public and to the industrial public the results of society research, to carry on THE GUIDE which had become a great symbol of the knowledge accumulated through the years, to build the strength of the Chapters, and to receive from these Chapters men and ideas to strengthen the national organization.

As there was no further business, the fifth session was adjourned with the announcement that a joint session with the *National Warm Air Heating and Air Conditioning Association* would be held in the Public Auditorium at 2:30 p. m.

Warm Air Heating

The sixth session, a joint meeting with the *NWAHACA*, was called to order at 2:30 p. m. in the ballroom of the Public Auditorium, by Alfred J. Offner, representing Dr. Woods, the newly installed president of ASHVE. Mr. Offner brought the greetings of the Society to the *NWAHACA* and extended an invitation to those present to visit the Society's Research Laboratory which was open for inspection until January 31.

F. E. Mehrings, Peoria, Ill., president of the *NWAHACA*, as co-chairman of the session, extended the greetings of that association to the ASHVE. He spoke of the close cooperation of the two organizations in the past and referred particularly to participation of association members in the exposition conducted under the auspices of the society.

Chairman Mehrings introduced Prof. S. Konzo, Urbana, Ill., who presented his paper, **Proposed Design Procedure for Large, Mechanical Warm Air Heating Systems** (to be published in the May, 1947, JOURNAL SECTION, *Heating, Piping & Air Conditioning*).

Dr. C.-E. A. Winslow assumed the chair and declared the meeting open for discussion of the paper.

H. B. NOTTAGE, Cleveland, Ohio, remarked that within the next two years certain experimental work to be undertaken at Case School of Applied Science would undoubtedly provide some of the information desired by Professor Konzo with regard to distribution and flow of heated air.

Controlling Air-Borne Micro-Organisms

The next paper, **Determining and Reducing the Concentration of Air-Borne Micro-Organisms**, by Matthew Luckiesh and A. H. Taylor, was presented by Dr. Taylor (published in January 1947 JOURNAL SECTION, *Heating, Piping & Air Conditioning*). The author mentioned that work on the subject had been continued since the paper was prepared. He showed by means of slides how petri dishes were prepared and used for sampling the bacterial count in air. He demonstrated the growth of bacteria colonies under temperatures equivalent to human blood temperature.

Dr. Taylor referred to an instrument which had been developed during the tests and stated that by means of it the germicidal energy of a germicidal lamp placed adjacent to it could be read directly. This was of great importance for the purpose of determining when a lamp had exceeded its period of useful life.

Another instrument mentioned by the author was one used to determine the reflectiveness of walls and ceilings. Since a minimum amount of reflection is desirable, he stated that fortunately most paints reflect very little ultraviolet radiation.

DR. C.-E. A. WINSLOW, New Haven, Conn. (WRITTEN): I have been deeply interested in the subject of air-borne infection for many years. I devised one of the earliest bacteriological air-samplers, a very crude one, and the impinger method was evolved (for the determination of atmospheric dusts) by Leonard Greenburg, M.D., in my laboratory. I, therefore, welcome this important contribution to the subject by Messrs. Luckiesh and Taylor, and congratulate the Society on having it presented before us.

There are three major steps which must be taken if the problem of controlling air-borne disease is to be solved on sound engineering lines.

In the first place, we must have generally accepted standard methods for judging the efficiency of a given mode of disinfecting air. The remarkable progress of water-bacteriology has been due to the acceptance of such standard methods which—while not perfect—have made possible intelligent comparison of different procedures of purification. We must agree on such standard methods for sanitary air analysis. Are we to measure pollution by the total number of colonies developing on a certain medium—and, if so, what medium? Or shall we use the acid-forming streptococci of the mouth as an index just as the colon bacillus of the intestine is used to measure pollution of water? I suspect that the results reported here today (with purification effectiveness ranging from nothing to a maximum of 75 per cent) might have been much more favorable if streptococci instead of total colonies had been used as measuring sticks. Shall we collect our samples by impingement alone or by an electrostatic process? Shall we use the Wells centrifuge, the Hollaender aeroscope, or the Luckiesh electrostatic device? Results will differ widely and will not be in any sense comparable, if different procedures are employed. It is of little consequence what proportion of the microbes in the air are collected, for no device collects them all. What we need is a method which gives us the ones which indicate most sharply the difference between good air and bad air; and above all what we need is agreement, for the time being, on one single standard procedure which will yield comparable results. The United States Public Health Service or the *American Public Health Association* should give us a standard procedure.

When we have agreed upon a generally-accepted measure of air purity, the next step is to compare the effectiveness of various procedures for air purification and their costs. There are at least three methods of reducing the bacterial content of air which have their ardent advocates. They are the reduction of organisms contributed to the air by floors, bedding, and other natural objects by treat-

ment of these objects with dust-holding oily substances; the disinfection of the air itself by the use of aerosols; and the use of ultra-violet light. Which of these three procedures accomplishes maximum results at minimum cost, no one can say; yet that is what the engineer must know in order to deal intelligently with the subject. He must know it, too, in relation to a particular problem. Oil treatment may be the method of choice for barracks, aerosols for a chicken house, ultra-violet for a school room.

Finally, it must be determined by the epidemiologist just how great the need is for air disinfection in a given space. All experts, I think, are agreed that some process of this kind is essential in the surgical operating room and in the contagious ward of a hospital. Beyond that, we cannot at present go with certainty. Experiments in army barracks during the war yielded conflicting results. Elaborate experiments are under way, in New York State and elsewhere, as to the actual effect of air disinfection in schools on the prevalence of respiratory disease; but these experiments will take several years to yield reliable results. At present, the most competent experts are not agreed that routine disinfection of the air of school rooms and auditoria is necessary or desirable. This subject is still in the experimental state; and the engineer should await the considered verdict of the experts in epidemiology before adopting any process as a general procedure.

W. L. FLEISHER, New York, N. Y. (WRITTEN): Over a period of years the Society has had papers presented on the effectiveness of radiant energy developed by lamps of definite wave length as a means of destroying airborne bacteria or viruses. This year we again have a paper exploiting this theory.

I am always impressed by the ease with which half facts or unresolved results are correlated with profound carelessness for which nothing in the empirical results warrants such conclusions.

The editor of this paper has categorically stated—"Bacteria and viruses regardless of their physical nature can be destroyed by suitable exposure to ultra-violet energy." The authors don't say that, only the editor, but that is the sort of thing that catches the public eye.

To me there are two interesting and salient observations that could be culled from this paper. One of them, of course, has been pertinent to every paper on this particular subject and that is the fact that only a certain definite wave length is lethal to bacteria and a virus. If we knew why this particular wave length, which has an energy factor of a definite amount, was the maximum lethal agency, we might approach the question of our own energy equilibrium with a little more certainty. Of course my objection to the vast propaganda of the electrical companies advocating the use of sterile lamps with wave lengths of 2600 Angstroms—to be exact, 2537—is due to the fact that this method has never really been practical. Years ago it was introduced in bakeries for the killing of mold spores (which actually could be eliminated by proper filtering). However, the electrical wave is only lethal if it can definitely strike the bacteria or virus and as long as these micro-organisms are concealed in any way from the direct rays, they continue their immunity.

The authors of this paper advocate stirring the dust that settles on the ground so that it can get into more intimate contact with the rays from these lamps which necessarily must be above the sight line of the occupants of the building due to the fact that exposure to germicidal energy produces erythema and conjunctivitis. The authors claim that air circulation aids in moving the micro-organisms into the upper air where germicidal energy can affect the micro-organisms. It would be my feeling that in developing this air movement, the germs or bacteria would be absorbed by the individuals in the enclosure and create more mischief than if they were allowed to remain quiescent.

Under the very best conditions the radiation from the lamps can only affect or destroy a certain number of these micro-organisms as indicated by the plates shown in the paper.

According to the authors, this entire subject is still in a very elementary and inconclusive state. If I may orient this method of air sterilization to the triethylene glycol or propylene glycol method investigated by Robinson of Chicago and the various members of the group at Northwestern, not to mention Dr. Stokes and Dr. Harris and his group at Philadelphia, I might say that seemingly saturation of the air with a vapor—such as the glycol vapor—being unaffected by exposure and completely occupying the space as far as any molecules would occupy a space, should have better chance of ultimate sterilization than the lamp method which is so dependent on accuracy of aiming.

However, in conclusion, I believe that a study of the kinetic energy of the particular wave length which has been proved lethal may lead to some elemental information which could be utilized to the advantage of the human race.

C. H. WHITE, New Bedford, Mass., asked whether any means were available for filtering disease germs from air circulated in ducts in order to make possible the use of a recirculating system for heating apartment buildings.

M. H. KLIEFOTH, Madison, Wis., inquired whether results of tests by the Army Surgeon General employing mechanical air filtration for reduction of bacteria in air had been published and Dr. Winslow stated that some of the results were published in the American Journal of Public Health.

R. L. KUEHNER, York, Pa., remarked that, in addition to positive and negative particles, there were particles which were neutral in regard to electric charge and he, therefore, inquired how they were taken into account in obtaining samples. He inquired whether comparison had been made between the authors' sampling instrument and other commonly used types.

PROF. S. KONZO, Urbana, Ill., noted that an electrostatic precipitator was used to collect the samples and asked why electrostatic precipitation should not be used as a means of reducing bacteria.

AUTHORS' CLOSURE: Dr. Taylor explained that even if all bacteria could be collected from air there still would be difficulty in identifying types. Therefore, experimenters in the field have decided to use one or two types of organisms as an index of contamination. He stated that Dr. Leon Buchbinder in New York City had used beta hemolytic streptococci bacteria which constitute less than 1 per cent of the collected bacteria as an index of contamination.

While the authors had not made comparisons of their instrument with other sampling apparatus, they had made comparison with a Hollaender funnel airoscope and had proved greater effectiveness. Efficiency of the authors' sampler was indicated by placing two samplers in series and demonstrating that the first sampler caught 50 times as many bacteria as the second.

Neutral particles to a large extent were expected to become charged by induction and would move to the nearest charged plate.

Replying to Mr. White's inquiry, the author stated that germicidal lamps placed in air ducts can kill any organisms in recirculated air.

Referring to germicidal lamps in Naval training stations and schools, the author pointed out the difficulty of obtaining definite test results because the subjects invariably were exposed to the germ-free air during only a part of each day. He estimated that germicidal lamps might reduce time lost due to respiratory infection by 10 per cent.

Chairman Winslow thanked Professor Konzo and Dr. Taylor for their interesting papers. As there was no further business, the meeting was adjourned at 4:30 p. m.

(left to right): Speaker, Keith T. Davis, Cleveland; A. V. Hutchinson, secretary, ASHVE; T. H. Urdahl, vice-chairman, Committee on Research; G. L. Tuve, first vice president ASHVE and Conference chairman; L. P. Saunders, chairman, Committee on Research

PANEL HEATING CONFERENCE
Approves ASHVE as Coordinator

MEETING in Cleveland on March 7, leaders of important segments of the heating, ventilating and air conditioning industry unanimously voted that the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS should undertake the correlation and coordination of research on radiant panel heating.

The meeting, held at the Society's Research Laboratory, was attended by 110 persons representing trade associations, technical societies, manufacturers, government agencies, colleges and universities.

The meeting approved the motion, "a committee of representative groups to be known as the Technical Advisory Committee on Panel Heating be selected to critically review the literature, to list all the problems requiring solution, and to break them down into the various phases in order of their importance." It was further moved that action be taken by the Technical Committee to study the need for research into instrumentation, physiological effects and heat transfer through and from materials. The motion included as a duty of the Technical Committee a survey to be conducted of available university and industrial laboratory facilities so that the Technical Committee could recommend to the ASHVE Committee on Research where further studies might be undertaken in the light of existing facilities and personnel.

Prof. G. L. Tuve, chairman of the conference and first vice president of the Society, at the opening session expressed appreciation for the attendance and stated that it was not the desire of the Society to take over all research in the panel heating field. Professor Tuve stated that it was only because of the apparent confusion in the field that the Society had called the meeting for the purposes of learning what research is now being conducted; to determine, if possible, what further research is needed; and to offer the services of the Society in the correlation and coordination of technical data. The same sentiments were expressed by L. P. Saunders, chairman, Committee on Research, and Cyril Tasker, director of research.

During the morning session, representatives of various technical societies and trade associations expressed their unanimous approval of the need for research in panel heating and of the desirability of the ASHVE taking the role of coordinator of that research.

A bibliography of more than 120 references to published information on panel heating, prepared by the Laboratory staff, was distributed to all persons attending the panel heating conference. A copy of this bibliography may be had by writing the ASHVE Research Laboratory, 7218 Euclid Ave., Cleveland 3, O.

Mr. Saunders is now in the process of selecting the Technical Advisory Committee on Panel Heating. Announcement of its personnel will be made at an early date.

Over 100 persons attended the Panel Heating Conference held at the Society's Laboratory

JUNE IS SEMI-ANNUAL MEETING TIME

A GALA time is promised to members attending the Society's Semi-Annual Meeting 1947 at the Hotel del Coronado, Coronado, Calif., according to plans announced by the Committee on Arrangements for the Southern California Chapter. R. A. Lowe, general chairman, has listed the committees that will be in charge of the various events that are planned.

Activities will start on Sunday June 1 when meetings of the Council and several committees are scheduled. Three morning technical sessions are planned for June 2, 3 and 4 and the afternoons will be reserved for inspection trips, sports and other entertainment activities.

The tentative program provides for presentation of nine technical papers at the three morning sessions and during an afternoon there will be a golf meet for which the Research Cup and Eichberg Memorial Cup will be the principal trophies for the competing golfers. Proposed trips to Old Town, Ramona's Wedding place and Balboa Park, an inspection trip to the Navy Yard and Consolidated Aircraft Plant in San Diego and a trip to Old Mexico are in prospect. For the ardent fisherman a deep sea fishing trip is planned and there is also sailing for the devotee of that sport. The top social feature of the meeting will be the Semi-Annual Banquet.

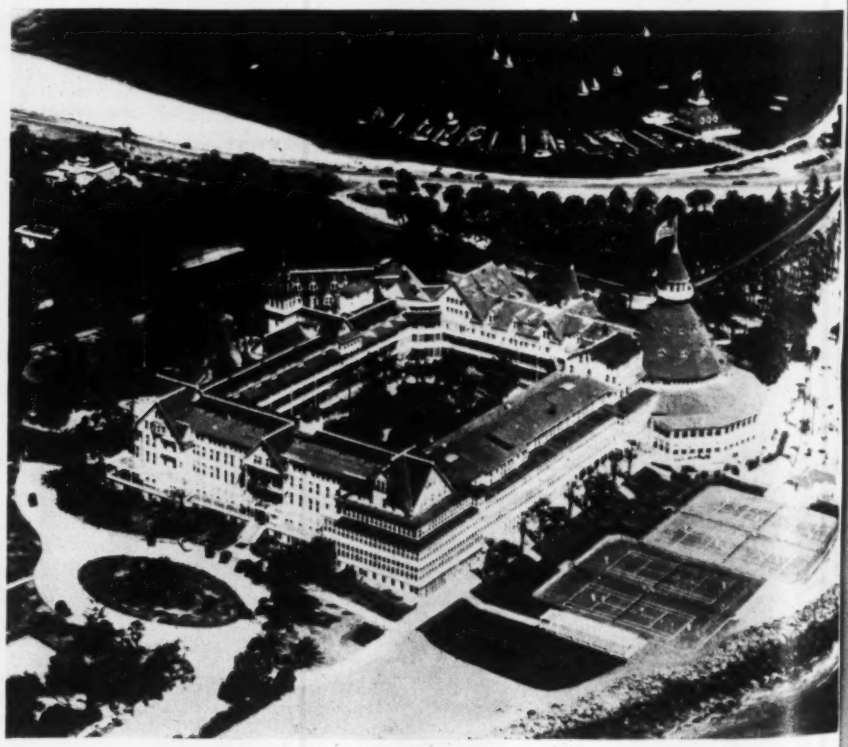
Coronado and nearby San Diego are renowned for providing year round sports activities. The Hotel del Coronado is on a peninsula overlooking the Pacific Ocean on one side and San Diego Bay on the other. The hotel is readily accessible from downtown San Diego via an auto and passenger ferry which crosses the Bay in less than 10 minutes. The trip by car requires about 40 minutes.

The hotel offers a special schedule of rates for the meeting on the American Plan which includes all meals. Special reservation forms will be mailed to members and rates are in accordance with the following schedule:

	Daily per Person
Room with bath, twin beds	$10.00
Room with bath, three beds	9.50
Suites—two rooms with bath between, four beds	10.00
Suites—two rooms, bath between, five beds	9.50
Suites—room with twin beds and bath and sun porch	10.00 plus 6.00
Suites—two rooms with twin beds, bath between and sun porch	10.00 plus 6.00
Room with twin beds and single room with bath between	10.00
Single rooms with bath (limited)	11.00
Two single rooms with bath between (limited)	10.00
Single room without bath (limited)	9.00
Twin bedroom without bath	8.50

Surrounding Coronado is a country which is rich in scenic beauty with many ancient missions, lofty mountains, extensive forest areas and the fascinating desert. Nature has given this area a comfortable climate and U. S. Weather Bureau reports reveal a mean temperature between the warmest and coldest months of only 14 degrees. In this sub-tropical land, where California was born more than 400 years ago, will be found some of the ancient missions and evidences of the architecture of Mexico and Old Spain. Balboa Park is one of the special points of interest with its 1400 acres which include some of the finest examples of architecture of the Spanish Renaissance period. Nearby is the famous Helix Greek Theatre and one of the places that

Many sports and other entertainment activities will be held at the Hotel del Coronado, headquarters for the Semi-Annual Meeting



San Diego is noted for its uniform temperature, with only 14 deg difference between the warmest and coldest months

JOURNAL SECTION

Committee on Arrangements

R. A. Lowe—Chairman; Maron Kennedy, R. S. Farr, J. L. Blake, Leo Hungerford. *Finance:*—W. N. Pauley—Chairman; *Reception and Publicity:*—E. A. Guenther—Chairman; *Sports Events:*—Bob Johnson—Chairman; *Hotels and Reservations:*—A. G. Orear—Chairman; *Outside Entertainment:*—J. S. Earhart—Chairman; *Ladies:*—A. B. Banowsky—Chairman; *Transportation (local):*—C. W. Pollock—Chairman; *Special Events:*—Vern Miller—Chairman; *Inspection Trips:*—Maron Kennedy—Chairman; *Industry Committee:*—L. B. Davenport—Chairman.

Tentative Program

Sunday—June 1

10:00 a.m. Registration
10:00 a.m. Committee on Research
2:00 p.m. Council meeting

Monday—June 2

9:00 a.m. Registration
10:00 a.m. Technical Session
10:30 a.m. Children's Sports
12:30 p.m. Luncheon
Deep Sea Fishing Trip
2:00 p.m. Roads to Romance—Old Town—Ramona's Wedding Place—Balboa Park (Buses Leave West Entrance of Hotel)
Golf Tournament—Research Cup and Eichberg Cup
Beach Party for Children
6:30 p.m. Dinner—Main Dining Room
8:30 p.m. Chapter Delegates Meeting
Movies

Tuesday—June 3

9:00 a.m. Registration
10:00 a.m. Technical Session
10:30 a.m. Ladies' Card Party
12:30 p.m. Luncheon
2:00 p.m. Harbor Cruise and Inspection of the Navy Yards. Leave Hotel Boat House
4:30 p.m. Nominating Committee Meeting
5:30 p.m. Social Hour
7:00 p.m. Banquet

Wednesday—June 4

10:00 a.m. Technical Session
12:30 p.m. Luncheon
2:00 p.m. Trip to Old Mexico.

FIRST CLASS RAILROAD FARES

City	Round-Trip	Pullman Lower Berth
Atlanta	$135.01	$21.68
Syracuse, New York	162.01	26.57
Columbus, Ohio	137.43	23.92
Cincinnati, Ohio	133.40	23.29
New Haven, Conn.	176.35	28.92*
New Orleans, La.	112.93	18.63
San Francisco, Calif.	34.16	4.03**
Chicago, Ill.	114.25	20.99
Indianapolis, Ind.	126.79	22.60
Des Moines, Iowa	103.21	18.98
Kansas City, Mo.	95.68	17.65
St. Louis, Mo.	108.33	19.95
Boston, Mass.	183.83	28.92*
Winnipeg, Man.	137.48	26.45
Toronto, Ont.	150.65	25.99
Montreal, Que.	172.79	28.98
Norfolk, Va.	170.73	27.31
Washington, D. C.	167.21	27.31
Milwaukee, Wis.	114.25	20.99†
Berkeley, Calif.	34.16	4.03**
Detroit, Mich.	135.30	23.92
Kalamazoo, Mich.	124.95	20.99†
Memphis, Tenn.	112.93	19.32
Minneapolis, Minn.	114.25	20.99
Omaha, Nebr.	95.68	17.65
New York, N. Y.	176.36	28.92
Durham, N. C.	158.67	25.70
Dallas, Texas	86.42	14.66
Houston, Texas	91.71	15.99
Oklahoma City, Okla.	80.74	16.96
Portland, Oregon	71.47	11.04**
Seattle, Wash.	81.88	12.65**
Philadelphia, Pa.	170.83	27.94
Pittsburgh, Pa.	148.18	24.96
Denver, Colo.	76.42	13.66
Los Angeles, Calif.	6.36	0.55††
Salt Lake City, Utah	51.58	7.99
Buffalo, New York	152.03	25.65
Lafayette, Ind.	119.71	22.60
St. Paul, Minn.	114.25	20.99

*Rate from N. Y. **Rate to Los Angeles only. †Rate from Chicago. ††Seat rate.

is always of interest to visitors en route to San Diego is Mt. Palomar, site of the World's largest observatory telescope.

Good roads lead to San Diego from the North and East and excellent service by rail and by airline is available. Rates from some of the principal cities are listed. Special arrangements are being made for several railroad itineraries from the East which will include time for sightseeing at scenic points en route.

It is expected that many members will combine business and pleasure in attending the Semi-Annual Meeting at Coronado. A double attraction is the Semi-Annual Meeting of the *ASRE* to be held the following week (June 9 to 11) in Los Angeles. The Arrangements Committee plans to assist members who want hotel reservations following the Coronado Meeting.

The Southern California Chapter members and the Committee on Arrangements extend a cordial invitation to come to Coronado in June and a sincere and friendly welcome to all.

Silver Anniversary Edition — GUIDE 1947

The 25th edition of the HEATING VENTILATING AIR CONDITIONING GUIDE is being distributed to ASHVE members (mailing started March 15) and is available for shipment on orders, which will be filled in order of receipt.

All of the 51 chapters of the Guide have been reviewed by the Guide Publication Committee with a group of 50 practicing engineers and other authorities who served with the committee. Important changes have been made wherever improvement could be effected either in presentation of material or in addition of useful data. Among the chapters that have been amplified or revised are the following:

The chapter on Cooling Load has been rewritten and includes an enlarged list of cities for which summer design conditions are given. Methods of determining components of heat and vapor gain are given in detail for homogeneous and composite walls. A detailed example in determining cooling load is included.

Treatment of Fuels and Combustion has been enlarged. Formulas for heat losses accompanying combustion have been added and several useful charts are included for easy determination of flue gas losses. In the chapter on Hot Water Heating Systems and Piping examples in piping design have been simplified. A formula for sizing closed expansion tanks has been added. Information on use and installation of air cleaners has been added to the chapter on Air Cleaning Devices.

The chapter on Unit Air Conditioners, Unit Air Cleaners, Attic Fans has been rewritten to include improved sections referring to the features of construction and factors influencing operation and application of unit equipment.

Revision of the chapter on Dehumidification by Sorbent Materials keeps this chapter abreast of present knowledge and practice in the sorbents field. An example in calculating moisture load is included.

The chapter on Refrigeration includes a description of the air refrigeration cycle; also, the section referring to absorption systems has been simplified.

The Air Duct Design chapter includes a friction loss chart for ducts as small as 1½ in. and a new chart facilitating corrections for pipe roughness.

Revision of the chapter on Marine Heating, Ventilating, and Air Conditioning provides new material based on Navy and merchant marine practice. Diagrams of typical marine air conditioning systems are shown.

The chapter on Water Services has been extended to include information on design of cold water piping systems. Charts provide friction loss for both rough and fairly rough pipe.

A complete cross index of the technical data section is included.

The Guide Publication Committee for THE GUIDE 1947 was: T. F. Rockwell, *Chairman*, R. C. Cross, R. S. Dill, B. H. Jennings, C. F. Kayan, A. B. Newton, G. H. Tuttle, W. M. Wallace, II, C. P. Yaglou, Cyril Tasker, *Ex-officio*, and Carl H. Flink, *Technical Secretary*.

An indication of the broad scope and appeal of THE GUIDE is afforded by reference to the preface in which appears a list of 50 Society members and others who assisted in preparation of the 25th edition.

Convenient reference to manufacturers' equipment is provided by the Catalog Data Section showing the products of 240 firms. This section is complete with a convenient list of manufacturers' names and addresses and a cross-index of products available.

THE GUIDE 1947 includes a roll of membership of the Society and contains 912 pages in the technical data section. It matches previous editions in size 6 x 9 in. and is bound in blue cloth cover stamped in silver. The price of THE GUIDE 1947 is $6.00 per copy.

INDUSTRIAL HYGIENE MEETING SCHEDULED IN BUFFALO

The *American Industrial Hygiene Association* will hold a three-day meeting at the Hotel Statler, Buffalo, N. Y., April 29-30, and May 1 and the tentative program has been announced. Among the subjects to be discussed are toxicology, environmental control, analytical procedures, which will include infra-red absorption analysis and x-ray diffraction analysis of dusts. During this three-day meeting there will be a joint meeting with industrial physicians and surgeons and a symposium on particle size, which will include papers on toxicity of uranium in relation to particle size, and the influence of particle size in dust exposures.

The association's officers include: President—Frank A. Patty, Detroit, Mich.; President-Elect—Theodore F. Hatch, Pittsburgh, Pa.; Past President—Robert A. Kehoe, M.D., Cincinnati, Ohio; Secretary—Allen D. Brandt, Sc.D., Bethlehem, Pa.; Treasurer—Carlton E. Brown, Sc.D., Pittsburgh, Pa.; Executive Secretary—Leon I. Shaw, Ph.D., Alfred, N. Y.

B. F. COOK AT NEW LOCATION

Benjamin F. Cook, consulting engineer, has announced that he will continue the general engineering practice and specialization in the design of power and industrial plants and the mechanical equipment of buildings at 1221 Baltimore Ave., Kansas City 6, Mo.

Mr. Cook, formerly with Walter E. Gillham, heating and ventilating engineer, served in the Corps of Engineers in the first world war, and in a civilian capacity in the last war. He has been a member of the Society for many years and served as secretary, treasurer and as a member of the board of governors of the Kansas City Chapter of the Society.

G. E. ANNOUNCES PROMOTIONS

R. U. Berry, formerly manager of the field engineering division, General Electric Co., has been named manager of the industrial, marine, and contractor division, with responsibility for sales of all department products to industrial, marine, and contractor customers and to agencies of the United States and state governments.

Mr. Berry was born in Portland, Ore., where he received his early education. He received his A.B. from Amherst in 1925 and his B.S. in electrical engineering in 1927 from MIT. Following his graduation he joined the staff of General Electric at Schenectady, N. Y., where he remained until 1931, when he was transferred to the Air Conditioning Department in the G. E. office at Dallas, Tex. In 1940 he was transferred to the Bloomfield, N. J., office. He joined the ASHVE in 1939.

Another promotion announced by G. R. Prout, vice president and general manager, is that of W. F. R. Karsten, who has been appointed sales manager of the refrigeration machine and remote equipment divisions.

ENGINEERS SEEK BOOKS AND FUNDS

An appeal has been directed to engineers to contribute to the drive to help restore war-damaged or destroyed technical libraries in Europe, Asia and the Philippines. The Committee on International Relations of the Engineers Joint Council, in issuing this appeal, has asked for money to purchase new books, and for selected used technical books and periodicals.

This fund will be used to fill specified needs of the damaged libraries and contributions should be sent to Joseph Pope, chairman, Book Commission, Engineers Joint Council, 29 West 39th St., New York 18, N. Y. The books themselves should not be shipped until full instructions are received. Donors of books will be furnished with bookplates with space to enter their names. This original bookplate bears the insignia of the five national societies of the Engineers Joint Council. The shipments overseas will be made through the American Book Center for War Devastated Libraries, Inc., Washington, D. C., through a cooperative arrangement with the engineers.

This appeal is to bring up to date the technical libraries that were shut off by the war from modern publications, and to foster the growth of new libraries in all the technically undeveloped countries of the world, by gifts of books and periodicals of American origin.

HOFFMAN APPOINTS E. L. MALM

Edwin L. Malm, a member of ASHVE, has been appointed assistant to Frank Gaylord, sales manager, Hoffman Specialty Co., Indianapolis, Ind., according to a recent announcement by Neil Skinner, president.

E. L. Malm

Mr. Malm, a graduate of the University of Michigan, is well known in the heating industry and has had many years of sales and engineering experience in the heating and ventilating field. He was formerly associated with the American Radiator Corp. and Crane Co., and for the past seven years he has been sales promotion manager of Bell and Gossett Co.

He will make his headquarters at the home office of the company at Indianapolis.

DEATH OF HARRY G. BLACK

At a recent meeting of the Philadelphia Chapter a resolution was passed in memory of Harry G. Black, past president of the Chapter, who died on January 11, 1947, after an illness which confined him to the hospital for a period of three months.

Mr. Black was born on March 20, 1883, at Lancaster, Pa., where he attended public schools. He joined the staff of P. Gormly Co. in 1903, working his way up from engineer to partner and finally sole ownership. During his long association with the company he was responsible for such well known buildings as the University of Pennsylvania Hospital buildings, the Dispensary, Surgical, Maternity and Nurses' Home; also the Veterinary Building, Chemical Laboratory, Zoological Laboratory and Library at the University. He was also in charge of the building construction of Mt. St. Alphonsus Seminary, Esopus, N. Y.; St. Mary's College, Northeast Pennsylvania; Mission Church Building, Brooklyn, N. Y., and many others.

Mr. Black, in recent years, devoted his time to hospital and industrial projects and he enjoyed an enviable reputation for quality of workmanship by both clients and business associates.

He joined the ASHVE in 1917 and had taken an active interest in both the national and local chapter activities. He served the Philadelphia Chapter as its president in 1930, vice president in 1929, and as a member of its Board of Governors for a number of years.

Mr. Black is survived by his widow, Mrs. Emily E. Black, and his daughter, Mrs. Ada B. Martin, 927 North 65th St., Philadelphia, Pa., to whom the Officers and Council of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS extend their deepest sympathy.

JOURNAL SECTION

Summary of Local Chapter Meetings*

ATLANTA—February 7, 1947. Subject: Atom Bomb Project. Speaker: Dr. R. J. Lageman, Emory University, Ga. Dr. Lageman described the four ways of producing atomic energy and answered many questions in the discussion that followed. Other Features: W. J. McKinney reported on the membership. G. R. Bilderback submitted a report on the chapter finances, followed by a report on codes by S. W. Boyd. W. M. Garrod gave his report on the 7th International Heating and Ventilating Exposition and H. King McCain spoke on the Society's Annual Meeting. President McCain appointed a ten man committee, with L. L. Barnes as chairman, to push the raising of funds for paying off the mortgage on the Society's Research Laboratory building. Attendance 44. Attendance ratio 0.44.

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CENTRAL NEW YORK—February 19, 1947. Subject: Smoke Abatement. Speaker: Prof. R. R. Tucker, head, mechanical engineering department, Washington University, St. Louis, Mo. Professor Tucker's talk included a discussion of how certain procedures had failed and where the emphasis should be placed to obtain results that are satisfactory to the citizens. The talk was practical and well received by the enthusiastic audience. Many local civic organizations were well represented. Attendance 38.

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CENTRAL OHIO — February 26, 1947. Subject: Battelle Memorial Institute. The meeting was held at the Institute and after a brief outline was given telling why Battelle Memorial Institute was founded, its purposes and its accomplishments, there was a tour of inspection. This enabled the members and guests to view the equipment and the many current investigations, which proved intensely interesting. Pres. H. R. Allonier thanked the officials of the Institute for their cordial welcome. Attendance 44. Attendance ratio 0.42.

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ILLINOIS — February 10, 1947. Subject: Frozen Food Developments. Speaker: F. T. Brandt, chief engineer, Westerlin and Campbell, Chicago, Ill. He gave an interesting talk and among the topics discussed were the use of refrigeration and the required temperatures in meat packing, ice cream manufacture, etc. Other Features: The various committee chairmen, Messrs. M. J. Bamond, J. F. Cummiskey, J. S. Kearney, and A. G. Stout, reported for their individual committees. Attendance 87. Attendance ratio 0.26.

ILLINOIS—January 13, 1947. Subject: Heating, Ventilating and Drying Problems in Agriculture. Speaker: H. D. Bruhn, associate professor of agricultural engineering, University of Wisconsin, Madison, Wis. Professor Bruhn told how heating and ventilating had been brought into close contact recently with agriculture because of barn hay curing. He also pointed out that heating and ventilating had many other applications on farms, including preventing condensation in barns for cattle, swine and sheep, poultry houses, drying corn and grains, and many miscellaneous uses. He suggested a portable unit which could be used in connection with several farm structures, possibly one which would include a power unit (gas or electric), a fan, and an automatically fired and controlled furnace. An interesting question and answer period followed. Other Features: Pres. O. J. Prentice welcomed the members of the *American Society of Agricultural Engineers* who were guests of the Illinois Chapter. Attendance 91. Attendance ratio 0.24.

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INDIANA — February 28, 1947. Subject: Home Heating and Air Conditioning of the Future. Speaker: Carl F. Boester, director, housing research, Research Foundation, Purdue University, Lafayette, Ind. Mr. Boester discussed the elements of the practical consideration from the standpoint of cost and application of heating for low priced homes. Before beginning his talk, Mr. Boester gave an informal talk on the Society, calling particular attention to the fact that the value of the national Society is based on the activity of the membership as a whole. He urged activity and interest on the part of the general membership in Society affairs and objectives. Mr. Boester answered many questions and the discussion continued long after the meeting was adjourned. Other Features: I. W. Cotton, chairman of the membership committee, reported on the progress of his committee. Pres. T. R. Davis made a brief statement on the fund to reduce the mortgage on the Society's Research Laboratory building in Cleveland. Chairman Fenstermaker reported for the program committee. G. B. Supple, as chapter delegate, gave an interesting report on the happenings at the Society's Annual Meeting and reported on the new organization of the nominating committee. Attendance 48.

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KANSAS CITY—March 3, 1947. Subject: Air Conditioning and Dehumidification. Speaker: Fred Johnson, sales manager, Air Conditioning Division, Surface Combustion Corp., Toledo, Ohio. Mr. Johnson illustrated his talk with slides which proved of interest. Other Features: Pres. S. L. Furbee presented a plan for raising funds as the chapter's contribution to the retirement of the mortgage on the Society's Laboratory building in

*Note: The attendance ratios shown represent the membership attendance divided by the chapter membership. These ratios will be useful as a partial indication of interest shown by local chapter members in various types of subjects programmed by the various chapters and may be useful in deciding on subjects for chapter meetings.

Cleveland. A goal was set for $300 to $500 and President Furber appointed two teams with E. E. Ralston and C. E. Perry as captains. Assisting on Mr. Ralston's team will be F. G. Ehlers, Paul Heckert, C. D. Jones, U. M. Scurlock and J. H. Traynor, and Mr. Perry's team will consist of L. E. Bruce, A. J. Edge, C. S. Flarsheim, C. W. Schumacher and A. R. Ward. The teams will report at the next meeting. Attendance 49.

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MEMPHIS—February 17, 1947. Subject: Reports on the Society's Annual Meeting in Cleveland. Pres. R. H. Hoshall called upon N. C. Ledbetter, chapter delegate, who gave detailed accounts of the chapter delegates' committee meetings and emphasized the amount of work and responsibilities imposed upon this committee. He also reported on discussions with delegates from the Texas Chapters who suggested that reciprocal mailing of chapter meeting notices be made and other pertinent information of mutual value be exchanged. J. B. Lammons, alternate, supplemented Mr. Ledbetter's remarks on the Annual Meeting with interesting details of the exhibits at the Heating and Ventilating Exposition held at the Auditorium in Cleveland during the same week. Messrs. Carl S. Fischer and Walker L. Wellford, Jr., also reported on the Annual Meeting, discussing the forum on panel heating. President Hoshall then opened a discussion on the participation of the Memphis Chapter in the present drive to reduce the mortgage on the Society's Research Laboratory building in Cleveland. Opinion as to the method of contribution was varied and Mr. Fischer made a motion, which was seconded and carried, that contributions of local members be directed to the treasurer of the Chapter and are to be received by April 15. Mr. Ledbetter's report of the Cleveland Meeting revealed the need for permanent historical data for Chapters and the Society, and President Hoshall appointed W. E. Thorpe to prepare such data to cover the history of the Memphis Chapter. Attendance 19. Attendance ratio 0.51.

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MICHIGAN—February 17, 1947. Subject: Controls for Radiant Heating Systems. Speaker: H. W. Alyea, research engineer, Johnson Service Co., Milwaukee, Wis. Mr. Alyea's talk covered the fundamentals and methods of radiant heating, the controls available for these systems, and stressed the importance of the use of a weather compensated control device for proper control. A rising vote of thanks was extended to Mr. Alyea. Other Features: This was the chapter's annual past presidents' night and 18 of the 25 living past presidents were in attendance. Messrs. E. F. Hyde, A. E. Knibb, and J. H. Spurgeon submitted their committee reports. Pres. F. R. Bishop gave a report on the Annual Meeting in Cleveland and spoke briefly on the chapter delegates' meeting. R. F. Connell read a letter from the Detroit Department of Safety regarding a proposed ordinance covering licensing of contractors for the installation of all boilers having a capacity in excess of 30 hp. Attendance 122. Attendance ratio 0.79.

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MINNESOTA—February 3, 1947. Subject: Unit Ventilators. Speaker: G. E. Otis, vice president, Herman Nelson Corp., Moline, Ill. Mr. Otis covered the history and development of this type of equipment and answered a number of questions after his talk. Other Features: Chester T. Lawrence reported on the progress of his committee on obtaining contributions for the fund to reduce the mortgage on the Society's Research Laboratory building in Cleveland. He reported that to date $404.00 had been received with an additional $135.00 promised and that the committee expects to reach a figure around $800.00 as the Chapter's contribution. Attendance 77.

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MONTREAL—January 20, 1947. Subject: Pneumatic Control. Speaker: Rex Vernon, sales promotion manager, Johnson Service Co., Milwaukee, Wis. Mr. Vernon presented an illustrated lecture which proved interesting and instructive and, according to the secretary, was the best talk given before the Montreal Chapter in many years. It was apparent that his being an active member of the Society for many years also added to the general interest. Other Features: G. Lorne Wiggs mentioned some of the highlights in the formation of the Montreal Chapter in 1936. A. B. Madden, retiring president, gave his report, which was favorably received by the members. It indicated real progress during the past two years under his guidance. As a token of appreciation the Chapter presented Mr. Madden with a Cape Cod lighter. Attendance 49.

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NEBRASKA—February 11, 1947. Subject: Activities of the Society's Annual Meeting in Cleveland. Messrs. D. E. McCulley, delegate, J. G. Bierl, secretary, K. R. Magarrell, treasurer, Fred Prall, B. G. Peterson and Henry Kleinkauf each reported on a different phase of the activities of the meeting, including the new heating and ventilating appliances on display at the Exposition at Lakeside Hall. Mr. McCulley's opinion was that the Annual Meeting was a very interesting and educational meeting, which was well planned, and felt that those responsible for the arrangements should be congratulated on the very successful meeting. He also remarked that it was gratifying to see the new Research Laboratory with the various set-ups under way. Mr. Bierl expressed surprise at the interest shown by the members attending the panel and radiant heating forum. He was also well pleased with the exhibits at the Exposition. Mr. Magarrell felt that his time was well spent in making the trip to Cleveland and reported on the highlights of the meeting. Mr. Prall announced that he had learned a great deal from the panel and radiant heating discussion, and while there was a difference of opinion on some aspects in which he was interested, it helped him to make decisions that he had heretofore been unable to fully decide upon in designing radiant heating

installations. Mr. Peterson stated that the meeting was thoroughly educational and well worth attending. Mr. Kleinkauf expressed surprise at the many new appliances exhibited and stated that it was evident that the manufacturers had good representation at the Exposition as they had sent their top men to Lakeside Hall. He too was very much interested in the panel and radiant heating forum. He spoke of the talk *Science of the Future* which was delivered by Dr. Kirtley Mather at the Society's annual banquet. He announced that the Nebraska Chapter's average contribution per member for the retirement of the research mortgage was $10.00 and was well pleased with the returns. Following all the discussions on the Meeting and Exposition an educational film was shown through the courtesy of the Chrysler Corp. Attendance 25.

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NEW YORK—February 17, 1947. Subject: Smoke Abatement. Raymond R. Tucker, professor of mechanical engineering, Washington University, St. Louis, Mo. Professor Tucker was introduced by A. H. Fletcher, New York City Department of Health, who outlined the steps being taken in smoke abatement in New York City. Professor Tucker outlined the procedure followed in St. Louis and described methods used to obtain effective enforcement of smoke laws. In the discussion that followed Professor Tucker provided much practical advice on smoke abatement methods in response to questions asked. A rising vote of thanks was extended the speaker for his interesting talk. Other Features: Floyd D. Lawrence, chairman of the membership committee, announced the total membership of the New York Chapter as 265. He then called attention to the rapid increase of the Minnesota Chapter to 175 and the Southern California Chapter to 210 as a reminder that the New York Chapter might lose its place as the largest Chapter in the Society. C. S. Pabst, chairman of the nominating committee, reported the following nominations for 1947-48 officers: President—M. C. Giannini; Vice President—A. A. Bearman; Treasurer—W. M. Heebner; Secretary—Carl H. Flink. Board of Governors: W. A. Sherbrooke, P. B. Gordon, Ernst Graber, H. S. Johnson, C. F. Kayan. President Sherbrooke submitted a report on the chapter delegates meeting at Cleveland and then announced that the next Annual Meeting would be held in New York, February 2-6, 1948, during the same week as the 8th International Heating, Ventilating and Air Conditioning Exposition. President Sherbrooke appointed C. Donald Fife, as a committee of one, to examine the bill introduced in Albany for amending the general business law relative to misrepresentation in the sale or installation of air conditioning systems or equipment. Mr. Fife was also appointed as chapter representative on the Standing Committee on Legislation for the Technical Societies Council of New York. Attendance 65. Attendance ratio 0.15.

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NORTH TEXAS—February 17, 1947. Subject: Thermally-Controlled Ventilation. Speaker: Albert J. Nesbitt, president, John J. Nesbitt, Inc., Philadelphia, Pa. Mr. Nesbitt delivered an interesting talk on providing thermally-controlled ventilation using unit ventilators in the classrooms of the schools in the Dallas area. He supplemented his talk using a variety of charts and tabulations, and the material presented was of great interest to the large number of engineers and architects present. Other Features: Pres. C. Rollins Gardner outlined the activities of the chapter delegates and nominating committees at the Annual Meeting in Cleveland, and gave a brief discussion as to the procedures followed. President Gardner also advised the members that owing to lack of available floor space, Dallas would not be suitable for an Annual Society Meeting, because of the decision to have a yearly Exposition in conjunction with the Annual Meetings each year. However, the formal invitation to the Society for an Annual Meeting in Dallas Pres. ident Gardner announced, would still stand, in the event the yearly show reverts to a biennial exposition. This was put into a motion and passed. Attendance 70. Attendance ratio 0.41.

NORTH TEXAS—January 20 1947. Subject: The American Patent System. Speaker: S. Austin Wier. Mr. Wier pointed out that the American patent system was not only the greatest single force making for the integrity of the American industrial system, but that it was the keystone of all great industrial nations. The Patent Office, he stated, was formed in 1840 and has issued some 2,300,000 patents to date. Touching on the history of revolutionary patents, Mr. Wier mentioned that the most contributing basic patents were listed as: *a.* the art of weaving and power looms; *b.* the cotton gin; *c.* the steam engine; *d.* transportation, including aviation; *e.* the telephone and telegraph; and *f.* the radio. He concluded his thought-arousing talk by upholding the present American patent system and stating that the patent laws, as we know today, are the basis of our great American *inquiring mind*, and along with our present scientific discoveries, make this country the greatest unexplored nation of the earth. A lively period of discussion followed with considerable interest shown by the members and guests. Other Features: Pres. C. Rollins Gardner announced the formation of a new committee on legislation with R. R. Matthews as chairman. A letter was read from past president E. J. Stern, in which he instructed that lapel emblems be awarded to the *one hundred percenters* for the year 1946. The recipients of the emblems are Messrs. Gardner, Foss and Poythress. Attendance 55. Attendance ratio 1.37.

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ONTARIO—March 3, 1947. Joint meeting with Western New York Chapter. Subject: Panel Discussion on Future Trends in the Heating and Ventilating Industry. The Ontario representatives in the panel consisted of Messrs. R. S. Matheson, Alex McKenzie, and John Ross. Following dinner, R. Lance Rumble

general sales manager, General Motors, Canadian Truck Division, spoke on *Rumble's Rambling*, one of his inspirational talks for which he is so justly famous. An hour's entertainment provided by Charles Bodley's troupe followed Mr. Rumble's address. Attendance 124. Attendance ratio 0.43.

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OREGON—February 6, 1947. Pres. W. Bruce Morrison presided and gave complete details on the Society's Annual Meeting in Cleveland. He was well pleased with the representation from the Oregon Chapter. He gave an interesting description of the Society's Research Laboratory and the various meetings and the Exposition. The nominating committee announced the following as nominations for officers for the coming season: President—C. W. Brissenden; Vice President—E. R. Lokey; Secretary—L. G. Williams; Treasurer—R. C. Chewning. Board of Governors: W. Bruce Morrison, W. J. Kollas, W. R. Norte. Attendance 49.

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PACIFIC NORTHWEST — February 11, 1947. Subject: Air Filters. Speaker: William Pauley, chief engineer, Farr Company. Following Mr. Pauley's interesting and informative talk, W. M. Wallis gave a few of the highlights of the Society's Annual Meeting in Cleveland. Attendance 18.

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PHILADELPHIA — February 13, 1947. Subject: Air Distribution for Heating and Cooling. Speaker: Mel J. Stevenson, consulting engineer, The Pyle-National Co., Industrial Multivent Division, Chicago, Ill. Other Features: M. F. Blankin, past president of the Society, announced the increase in contributions for reducing the mortgage on the Research Laboratory building in Cleveland. A resolution in memory of the late Harry G. Black, past president of the Chapter, was presented. Attendance 85. Attendance ratio 0.54.

PHILADELPHIA—January 9, 1947. This meeting was the annual entertainment meeting of the Philadelphia Chapter and no business was conducted.

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PITTSBURGH—February 10, 1947. Subject: Plastic Packing. Speaker: H. Graber, district representative, Seal-Pell, Inc. Mr. Graber gave a wide variety of uses for plastic packing, stating that it was not only used as a protection for shipping, but also as a protective coating against rust, corrosion, abrasion, chipping, and many other uses. An interesting discussion followed in which Mr. Graber answered many questions. Other Features: John F. Collins, Jr., gave a detailed report of the happenings at the Annual Meeting in Cleveland and announced that the Semi-Annual Meeting would be held at Coronado, Calif., June 2-4, 1947, and that the next Annual Meeting was scheduled for New York. Pres. A. F. Nass announced a joint meeting with the *ASRE* to be held in April. President Nass also appointed the nominating committee consisting of the following: Mr. Collins, chairman; H. J. Kirkendall and T. F. Rockwell. Attendance 19. Attendance ratio 0.22.

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ROCKY MOUNTAIN—February 14, 1947. Subject: Radiant Heat. Speaker: J. A. Selby, Jr., Chase Brass & Copper Co. Mr. Selby showed some interesting slides and a lengthy discussion followed. Attendance 79.

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ST. LOUIS—February 4, 1947. Subject: Industrial Exhaust Ventilation and Dust Control. Speaker: John M. Kane, chief engineer, dust control division, American Air Filter Co., Louisville, Ky. Mr. Kane elaborated on methods used for preventing dust escapement from industrial processes and gave some basic design figures and a comparison between exhaust ventilation and conventional heating and ventilating practice. His talk was illustrated with slides and was well received. A discussion followed Mr. Kane's talk, which proved the interest of the audience. Vice Pres. J. H. Carter thanked the speaker on behalf of the St. Louis Chapter for his excellent talk. Attendance 32.

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SOUTH TEXAS — February 21, 1947. Subject: Some Recent Developments in Adsorption Dehydration. Speaker: George L. Simpson, vice president, Pittsburgh, Lectrodryer Corp., Pittsburgh, Pa. A vote of thanks was extended to the speaker for his fine address. Other Features: C. C. Quin, delegate to the Annual Meeting in Cleveland, gave a good description of the events at the meeting. D. M. Mills, alternate, touched on some of the extra curricular activities at the meeting and his remarks were well received. R. F. Taylor spoke in his capacity as a member of the Council of the Society, giving a good idea as to the purposes of the Council and the action taken at the meetings. Attendance 90.

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SOUTHERN CALIFORNIA — February 12, 1947. Subject: Warm Air Heating Research. Speaker: C. W. Pollock, chief engineer, Drayer-Hanson, Inc., Los Angeles. Mr. Pollock explained that the data for this talk were gathered while he was with the Southern California Gas Co. He showed slides covering temperature records for the heating seasons in Los Angeles from 1870 to 1940. He also showed illustrations of a test house and explained the methods of recording temperatures and air requirements. Other Features: Leo Hungerford reported on the contributions by the various chapters toward paying off the mortgage on the Society's Research Laboratory in Cleveland, and stated that, to date, the Southern California Chapter was second in the amount donated. Attendance 89.

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SOUTHWEST TEXAS—January 20, 1947. Subject: Organization of ASHVE. Speaker: Dr. F. E. Giesecke, past president of ASHVE and professor emeritus, Texas A & M College, College Station, Tex. He

spoke on the problems of the new Chapter and then went into a discussion on radiation, panel and radiant heating. Following his talk he presented the Charter for the Southwest Chapter to Pres. F. C. Benham, Jr., who received it in behalf of the members of the Chapter. Dr. Giesecke was elected honorary Life President of the Chapter and R. W. Barnes was selected as official representative of the Chapter to the Annual Meeting, with George R. Rhine as alternate. Adolph J. Rummel, acting as chairman of the nominating committee, presented the nominees for office who were elected as follows: *President*—F. C. Benham, Jr.; *Vice President*—George R. Rhine; *Secretary-Treasurer*—Lawrence S. Pawkett; *Board of Governors:* F. C. Benham, Jr., R. W. Barnes, I. W. Wilke, D. E. Locher, A. J. Rummel, E. P. Weatherby. Attendance 20.

SOUTHWEST TEXAS—November 1, 1946. Subject: The Influence of Aviation and Automotive Heat Transfer Surface Development in the Heating and Air Conditioning Field. Speaker: L. P. Saunders, chairman, ASHVE Committee on Research, and chief engineer, Harrison Radiator Division, General Motors Corp., Lockport, N. Y. Mr. Saunders illustrated many different types of heat transfer surfaces, and an interesting discussion followed. No business was transacted since the Charter had not been presented to the Chapter. Attendance 16.

SOUTHWEST TEXAS — October 9, 1946. Organization Meeting of the Chapter. A. J. Rummel called the meeting to order and welcomed the local group and out of town visitors, and then turned the meeting over to Dr. F. E. Giesecke, who acted as temporary chairman. The meeting was called by a group of ASHVE members in order to make application for a local chapter and to hear an address by Alfred J. Offner, president of the Society, New York, N. Y. President Offner spoke on The Post War Era—A Challenge to Heating and Air Conditioning Engineers. A. V. Hutchinson, secretary of the Society, outlined the procedure for the establishment of a local chapter and also spoke on the organization of chapters and their relation to the national Society. Messrs. D. M. Mills and W. J. Way, II, representing the South Texas Chapter, and Messrs. C. Rollins Gardner and L. S. Gilbert, representing the North Texas Chapter, spoke to the group and welcomed the formation of a new chapter. The temporary officers were elected as follows: President—F. C. Benham, Jr.; Vice President—George R. Rhine; Secretary-Treasurer—R. W. Kotzebue.

President Offner also spoke on the activities of the ASHVE and described the activities and plans of the new Research Laboratory at Cleveland.

Motion was made, seconded, and carried that an application for the Southwest Texas Chapter be submitted to the Secretary of the Society. Attendance 48.

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UTAH—February 5, 1947. Subject: Annual Meeting in Cleveland. E. J. Watts, chapter delegate, reported on the activities of the 53rd Annual Meeting, outlining the regulations governing the chapter delegates committee and the procedure followed in electing the members of the Society's Nominating Committee. He further described the dedication ceremonies at the Research Laboratory and mentioned the drive now under way to retire the debt on the Laboratory building. Following the report of the Chapter delegates, Messrs. Alvin R. Dyer, A. Ray Cuttis and Earl V. Gritton each gave interesting highlights of the Meeting, the displays at the Heating and Ventilating Exposition, and the panel and radiant heating forum, which brought forth considerable discussion. R. H. East, a member of the nominating committee of the Chapter, announced that the following candidates had been nominated for officers to be elected at the next annual meeting of the Chapter: President—Earl V. Gritton; Vice President—Edward J. Watts; Secretary-Treasurer—C. E. Ferguson. A round table discussion developed on the subject of radiant heating and the meeting turned out to be one of the most interesting held by the Utah Chapter. Attendance 16. Attendance ratio 0.41.

MINNESOTA CONFERENCE AND EXPOSITION

The Minnesota Federation of Engineering Societies held its silver anniversary conference at the Hotel Radisson, Minneapolis, Minn., in conjunction with its second engineering exposition held at the Minneapolis Armory, February 26 to March 1, 1947. Other societies which held annual meetings concurrently with the conference were the *Minnesota Association of Professional Engineers*, and the *Minnesota Surveyors' and Engineers' Society*.

The ASHVE was ably represented by Prof. A. B. Algren, head, division of heating, ventilating and air conditioning, University of Minnesota, who spoke on panel heating followed by J. E. Haines, vice president, Minneapolis-Honeywell Regulator Co., and president of the Minnesota Chapter of the ASHVE who addressed the meeting on panel heating controls. Lyman C. Gross, vice president of the Minnesota Chapter of the Society, presided at this session.

Chapter display

Paul R. Speer was general chairman of the annual meeting committees, assisted by W. H. Gille, chairman of the engineering conference and Fred Klass, chairman of the exposition.

Other speakers besides Professor Algren and Mr. Haines were Robert Aldrich, Prof. S. R. B... Cooke, Dr. Donald J. Cowling, John Daeson, J. E. P. Darrell, Dr. Ovi... Wallace Eshbach, George Grim...

John C. Hunner, C. C. Jordan, Floyd C. Kelley, H. S. Lee, Thomas J. McCabe, Col. E. B. Miller, E. B. Newton, Melchior Palyi, Vernon S. Peterson, Clayton E. Plummer, Dean L. H. Reyerson, L. L. Schroeder, George M. Shepard, Dr. J. Robert Van Pelt, Jr., and Gordon Volkenant.

Over 50 of the leading engineering firms as well as engineering societies were represented at the exposition.

NEW APPOINTMENTS AT KIMBERLY-CLARK

Announcement of promotions in the sales research and engineering division of Kimberly-Clark Corp., Neenah, Wis., places Leonard E. Pasek, senior product engineer, in charge of sales engineering for the creped wadding products manufactured by the corporation, and M. W. Keyes and S. L. Swenson as product engineers. Messrs. Pasek and Keyes are members of ASHVE.

R. S. M. WILDE DIES IN DETROIT

One of Detroit's prominent engineers, Raymond S. M. Wilde, who had been a consultant in heating, ventilating engineering work and its branches for over forty years, died on March 5, 1947.

Mr. Wilde was born on April 14, 1884, at Pontiac, Mich., and received his early education in local schools. He served as a draftsman first with the American Blower Corp., and then with Smith, Hinchman and Grylls in Detroit.

From 1916 to 1934, Mr. Wilde had his own engineering firm specializing in the design and specifications of heating, ventilating and air conditioning, plumbing and electrical systems for all types of buildings. During this period he was responsible for the mechanical equipment in many theaters, hotels, office buildings, schools, and other public buildings in various parts of the country, among which were, A.I.U. Building, and the Deshler-Wallick Hotel, Columbus, Ohio, Fox Theaters in Detroit and St. Louis and many others. From 1934 to 1940 he was associated with Derrick and Gamber as mechanical engineer and from 1940 until his death he was mechanical engineer for Giffels and Vallet.

Mr. Wilde took an active interest in the Michigan Chapter of the Society and served as its president and on its Board of Governors. He frequently wrote for the technical press and presented several papers before the Society and before several of its Chapters.

The Officers and Council of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS extend their sincere sympathy to his widow, Mrs. Wilde, a daughter, Mrs. Gretchen Moeller, and to Ray Wilde, Jr., for the great loss they have sustained.

Candidates for Membership

The Constitution of the Society, as now amended, requires the following mode of procedure in voting on applicants for membership in the Society. All applications for membership are to be sent to the Secretary and the names of applicants and their references shall be printed in the next issue of the JOURNAL of the Society or sent to the members in other approved manner as ordered by the Council. When the replies are received from references, the Candidate's application shall be submitted to and acted upon by the Committee on Admission and Advancement as soon as possible.

When the Committee on Admission and Advancement has acted favorably upon a Candidate's application and assigned his grade, the Council shall vote upon the election of the proposed Candidate for membership by letter ballot. During the past month 74 applications for membership have been received and the names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Committee on Admission and Advancement, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by April 25, 1947, these candidates will be balloted upon by the Council. Those elected to membership will be notified by the Secretary immediately after election.

AIKEN, HECTOR H., Special Research Asst., University of Illinois. PROPOSERS: W. S. Harris, J. R. Fellows. SECONDERS: N. A. Parker, M. K. Fahnestock.

ANDERSON, JAMES T., Instructor, Michigan State College. PROPOSERS: L. G. Miller, C. H. Pesterfield. SECONDERS: F. C. Warren, T. D. Stafford.

ARNDT, MARQUARD H., Chief, Mech. Stds. Div., National Housing Agency. PROPOSERS: A. C. Crawford, W. H. Littleford. SECONDERS: W. A. Russell, J. N. Stewart.

BAKER, JOHN G., Chief Engr., Viking Manufacturing Corp. PROPOSERS: P. B. Sagar, J. E. Wilhelm. SECONDERS: E. C. Webb, J. H. Hart.

BECKER, PHILIP F., Elec. Engr., Board of Transportation. PROPOSERS: T. R. Peyrek, H. S. Wheller. SECONDERS: C. H. Smith, F. D. Lawrence.

BORZELLO, NICK, Engr., Drying Systems, Inc. PROPOSERS: M. J. Bamond, C. M. Burnam, Jr. SECONDERS: C. E. Price, O. J. Prentice.

BOWERS, ORRIN E., Engr. & Sales Mgr., Boyle Fuel Co. PROPOSERS: A. R. White*, R. L. Nelson*. SECONDERS: W. P. Gale*, L. J. Boyle*.

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BUCK, WILLARD B., Instructor, Minneapolis-Honeywell Regulator Co. PROPOSERS: J. E. Haines, E. F. Snyder. SECONDERS: W. T. Burton, R. M. Balch, Jr.

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*Non-member.

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WALLEN, GEORGE R., Asst. Chief Engr., Anemostat Corporation of America. PROPOSERS: V. F. Self, Fritz Honerkamp. SECONDERS: J. B. Hewett, L. R. Phillips.

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WILLIAMS, WILLIAM E., Dist. Office Mgr., The Powers Regulator Co. of Canada, Ltd. PROPOSERS: D. A. Stott, R. S. Libby. SECONDERS: J. P. Fitzsimons, W. W. Timmins.

Candidates Elected

In the past issues of the JOURNAL of the Society the names of the following men were listed as Candidates for Membership. The membership grade of each Candidate has been assigned by the Committee on Admission and Advancement and balloted upon by the Council. We are now instructed by the Council to post herewith, as required by Art. B-III, *Section* 8, of the By-Laws, the following list of candidates elected:

Members

ALLEN, S. RUSHMORE, Field Engr., American Blower Corp., Washington, D. C.

ATTEBERRY, CLARK, Owner, Atteberry's Heating & Sheet Metal Works, Mercedes, Tex.

BENN, CHARLES L., supvsr., Utilization Engrg., Equitable Gas Co., Pittsburgh, Pa.

BENNETT, CHARLES A., Asst. Mech. Inspector, Dept. of Justice, Bureau of Prisons, Washington, D. C. (*Reinstatement*)

ELLIOTT, CHARLES L., Supvsr., Htg. Engrg. Div., Cincinnati Gas & Electric Co., Cincinnati, Ohio.

GIANNINI, ALBERT A., Sales Engr., Carrier Corp., New York, N. Y.

GODES, ELLIOT, Engr., Anemostat Corp. of America, New

HARRIS, ALBERT M., Pres., Harris & Beeman, Inc., Fort Worth, Tex. (*Reinstatement*)

KLUGE, BURNETT M., Application Engr., Bayley Blower Co., Milwaukee, Wis. (*Advancement*)

LANG, LAWRENCE P., Sales Engr., Warren Webster & Co., Chicago, Ill. (*Reinstatement & Advancement*)

LE GRAND, IRVING F., Partner & Mgr., Air Engineers, Allentown, Pa.

ORR, GEORGE M., Cons. Engr., G. M. Orr Engineering Co., Minneapolis, Minn. (*Reinstatement*)

QUINLIVAN, LAURENCE P., Application Engr., York Corp., Cincinnati, Ohio.

ROMA, G. N., Engr. and Estimator, Carlson Manufacturing Co., Barberton, Ohio.

SATTERLEE, HARRY A., Partner, The Schulte Plumbing & Heating Co., Joplin, Mo. (*Advancement*)

SAWYER, CLIFFORD C., Cons. Engr., Phoenix, Ariz.

Associate Members

ALLEN, RAYNOLD W., Mgr., Htg. Dept., Atlas Supply Co., Winston-Salem, N. C.

ALLEN, ROBERT C., JR., Branch Mgr., General Controls Co., Kansas City, Mo.

ARMSTRONG, ROY E., Bldg. Chief Engr., Humble Oil & Refrigerating Co., Houston, Tex.

AUERBACH, LEONARD F., Sales Engr., The Spohn Heating & Ventilating Co., Cleveland, Ohio.

BALSTER, JOSEPH A., Chief Engr., Cafritz Co., Washington, D. C.

BECRAFT, E. R., Dept. Mgr., The Trane Co., La Crosse, Wis.

BERNHARDT, RAYMOND J., Mech. Engr., U. S. Army Engineers, San Antonio, Tex.

BOHREN, ARTHUR H., Owner, Bohren Plumbing Service & Supply Co., Portland, Ore.

CASTROW, O. E. C., Estimator, Asbestos Supply Co., Portland, Ore.

COOPER, JOHN A., Sales Engr., W. F. Slater Engineering Corp., Memphis, Tenn.

COUSART, KIRKPATRICK, Mfrs. Repr., Lydon-Cousart Co., Charlotte, N. C.

DESMOND, OWEN, Sales Mgr., Modine Manufacturing Co., Racine, Wis.

DEVLIN, JAMES J., Partner, W. C. Devlin & Sons, Bayonne, N. J.

DEYO, CLYDE D., JR., Asst. Chief Power Plant Engr., Electro-Motive Div., General Motors Corp., La Grange, Ill.

DUITCH, PAUL R., Mech. Engr., Iowa Sheet Metal Contractors, Inc., Des Moines, Ia.

DUKE, RAYMOND Q., Mechanical Heat & Cold, Inc., Detroit, Mich.

EASTIN, MAURICE R., Eastern Zone Mgr., Railway Controls Div., Minneapolis-Honeywell Regulator Co., New York, N. Y.

EBERHART, JOSEPH F., Engr., Kerby Saunders Inc., Buckhead, Ga.
EDWARDS, IRVIN G., Sales Engr., The Trane Co., Cincinnati, Ohio.

FRENSDORF, STUART F., Sales Engr., Air Filter Equipment Co., Inc., Cleveland, Ohio.
FROEHLICH, BERNARD F., Owner, Miami Heating Co., Cincinnati, Ohio.

GEBUHR, JOHN V., Assoc. Engr., Brown Engineering Co., Des Moines, Ia.
GERRISH, JOHN K., Sales Engr., Morgan-Gerrish Co., Minneapolis, Minn.
GRETTON, JOHN D., Mech. Designer, Department of Public Works, Toronto, Ont., Canada.
GRIMM, LYSLE E., Engr., Sidles Co., Omaha, Nebr.

HENRY, ALLAN, Partner & Design Engr., Refrigeration Equipment Co., Austin, Tex.
HUBER, PAUL O., Partner, Midgley-Huber, Salt Lake City, Utah.

IZARD, LOUIS W., Sales Engr., Reeves Wiedeman Co., Kansas City, Mo.

JANDER, YORKE G., Pres., Admiral Air Conditioning Corp., New York, N. Y.
JOHNSON, JOHN B., JR., Project Engr., Surface Combustion Corp., Columbus, Ohio.
JOHNSON, WALTER R., Chief Engr., Nickey Brothers, Inc., Memphis, Tenn.

KIDDER, K. B., Estimator, Harold E. Peterson Co., Los Angeles, Calif.
KUGEL, EDMUND F., Installation Supt., Montag Store & Furnace Works, Portland, Ore.

MANCHESTER, F. P., JR., Engr., Sidles Co., Omaha, Nebr.
MATHERS, WILLIAM, Partner, Mathers-Curl & Assocs., Columbus, Ohio.
MAYO, WILLIAM P., JR., Engr., Royal Air Conditioning Co., Houston, Tex.
MCALLISTER, A. F., Repr., A. M. Byers Co., Salt Lake City, Utah.
MCGHAN, FRED W., Mech. Engr., National Housing Agency, Washington, D. C.
MONTAGUE, FREDERICK H., Mech. Engr., Walter Scholer & Assocs., Lafayette, Ind.
MORRIS, BROOKS, Owner, Heating Engineering & Sales Co., Indianapolis, Ind.
MURPHY, ROBERT C., Application Engr., Westinghouse Electric Corp., Boston, Mass.

OSWALD, LEROI S., Draftsman-Engr., Firestone Tire & Rubber Co., Akron, Ohio.
OTTEN, WILLIAM A., Sales Engr., Laclede Gas Light Co., St. Louis, Mo.

PAUL, LAWRENCE O., Vice-Pres., Narowetz Heating & Ventilating Co., Chicago, Ill. (*Reinstatement*)
PINDELL, WILLIAM R., Mgr., Northwest Foundry & Furnace Co., Portland, Ore.
PINK, WILSON V., Research Engr., John B. Pierce Foundation, Raritan, N. J.
PLOESSER, HERBERT M., Engr., Condaire Inc., St. Louis, Mo.

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REAMY, WILLIAM C., JR., Partner, Meleney Engineering Co., Washington, D. C.
REDDINGTON, RICHARD T., Service Mgr., Delco Appliance Div., General Motors Corp., Rochester, N. Y.
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SWARTLING, EUGENE R., Engr., General Air Conditioning & Heating Co., Inc., Oakland, Calif.

VAN SPRIELL, LEWIS, Gen. Mgr., Wierenga Bros., Grand Rapids, Mich.

WATKINS, JOHN C., Sales Engr., Airtherm Manufacturing Co., St. Louis, Mo.
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WIEGAND, HORACE M., Sr. Process Engr., Servel Inc., Evansville, Ind.
WILD, HARRY, Tech. Engr., Atmospheric Control Ltd., Stockport, Cheshire, England.
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LANKOW, RICHARD P., Branch Mgr., Johnson Service Co., Portland, Ore.

MASON, ROBERT E., Engr., Sidles Co., Omaha, Nebr.

REUSCHLEIN, CLIFFORD J., Engr., Hyland, Hall & Co., Madison, Wis.

WALKER, KENNETH A., Mech. Engr., Area Engineering Office, Manhattan Dist., Chicago, Ill.

WEST, WILLIAM P., Sales Engr., Johnson Service Co., Atlanta, Ga.

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CALLINS, JACK G., Student, Texas A & M College, College Station, Tex.

COOK, ROBERT L., Student, Texas A & M College, College Station, Tex.

GOLDMAN, SIEGMUND, Student, Texas A & M College, College Station, Tex.

HUMBLE, JOHN D., Student, Texas A & M College, College Station, Tex.

JAHN, RUDOLPH, JR., Student, Texas A & M College, College Station, Tex.

SHEFFLER, MARCUS A., Student, Drexel Institute of Technology, Philadelphia, Pa.

WALLIS, WILLIAM E., Student, Texas A & M College, College Station, Tex.

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Central New York: Organized, 1944. Headquarters, Syracuse, N. Y. President, C. F. Woese, 1001 Burnet Ave., Syracuse 3. Secretary, Margaret M. Ingels, 300 S. Geddes St., Syracuse 1.

Central Ohio: Organized, 1944. Headquarters, Columbus, Ohio. Meets, Third Monday. President, H. R. Allonier, 101 N. High St., Columbus 15. Secretary, W. M. Myler, Jr., P. O. Box 267, Columbus 16.

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Delta: Organized, 1939. Headquarters, New Orleans, La. Meets, Second Tuesday. President, W. P. Oster, 410 Camp St., New Orleans 12. Secretary, F. G. Burns, 317 Baronne St., New Orleans 9.

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Golden Gate: Organized, 1937. Headquarters, San Francisco, Calif. Meets, First Wednesday. President, James Gayner, 624 Hearst Bldg., San Francisco. Secretary, H. V. Hickman, 1129 Folsom St., San Francisco 1.

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Illinois: Organized, 1906. Headquarters, Chicago, Ill. Meets, Second Monday. President, Oliver J. Prentice, 450 E. Ohio St., Chicago 11. Secretary, C. M. Burnam, Jr., Room 1605, 6 N. Michigan Ave., Chicago 2.

Indiana: Organized, 1943. Headquarters, Indianapolis, Ind. Meets, Fourth Friday. President, T. R. Davis, 805 K. P. Bldg., Indianapolis 4. Secretary, P. R. Jordan, 311 E. South St., Indianapolis.

Iowa: Organized, 1940. Headquarters, Des Moines, Ia. Meets, Second Tuesday. President, E. O. Olson, 3009 Sixth Ave., Des Moines. Secretary, D. C. Murphy, 214 Old Colony Bldg., Des Moines 9.

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Kansas City: Organized 1917. Headquarters, Kansas City, Mo. Meets, First Monday. President, S. L. Furber, 7429 Forest Ave., Kansas City 5. Secretary, H. E. Gould, 1800 Baltimore, Kansas City 8.

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Manitoba: Organized, 1935. Headquarters, Winnipeg, Man., Canada. Meets, Third Thursday. President, Robert E. Moore, 107-216 Graham Ave., Winnipeg. Secretary, J. R. Stephenson, 278 Main St., Winnipeg.

Massachusetts: Organized, 1912. Headquarters, Boston, Mass. Meets, Third Tuesday. President, C. W. Larson, 128 Brookside Ave., Jamaica Plain, Boston 30. Secretary, A. Ehrenzeller, 23 Parklawn Rd., Boston 32.

Memphis: Organized, 1944. Headquarters, Memphis, Tenn. Meets, First Monday. President, R. H. Hoshall, 65 McCall Pl., Memphis. Secretary, A. T. Bevil, 1521 Waverly Ave., Memphis 6.

Michigan: Organized, 1916. Headquarters, Detroit, Mich. Meets, First Monday after 10th of month. President, F. R. Bishop, 8011 Dexter Blvd., Detroit 6. Secretary, L. A. Burch, 5853 Hamilton Ave., Detroit 2.

Minnesota: Organized, 1918. Headquarters, Minneapolis, Minn. Meets, First Monday. President, J. E. Haines, 2747 Fourth Ave. S., Minneapolis 8. Secretary, O. L. Lilja, 5000 16th Ave. S., Minneapolis 7.

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Nebraska: Organized, 1940. Headquarters, Omaha, Neb. Meets, Second Tuesday. President, H. Y. Kleinkauf, 514 S. 11th St., Omaha 8. Secretary, J. G. Bierl, 4927 N. 34th Ave., Omaha.

New York: Organized, 1911. Headquarters, New York, N. Y. Meets, Third Monday. President, W. A. Sherbrooke, 114 Liberty St., New York 6. Secretary, Carl H. Flink, Room 3000, 51 Madison Ave., New York 10.

North Carolina: Organized, 1939. Headquarters, Durham, N. C. Meets, Quarterly. President, C. Z. Adams, 312 Piedmont Bldg., P. O. Box 1356, Greensboro. Secretary, M. F. DuChateau, 205 S. Lyndon St., Greensboro.

North Texas: Organized, 1938. Headquarters, Dallas, Tex. Meets, Third Monday. President, C. R. Gardner, 1000 St. Louis St., Dallas 1. Secretary, G. A. Linskie, 3124 Milton St., Dallas 5.

Northern Ohio: Organized, 1916. Headquarters, Cleveland, Ohio. Meets, Second Monday. President, J. E. Wilhelm, 1906 Euclid Ave., Cleveland 15. Secretary, D. E. Mannen, Jr., 9104 Woodland Ave., Cleveland 3.

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Oklahoma: Organized, 1935. Headquarters, Oklahoma City, Okla. Meets, Second Monday. President, G. T. Donceel, Oklahoma Natural Gas Co., Oklahoma City. Secretary, W. W. Frankfurt, 519 Apco Tower, Oklahoma City.

Ontario: Organized, 1922. Headquarters, Toronto, Ont., Canada. Meets, First Monday. President, V. J. Jenkinson, 1221 Bay St., Toronto 5. Secretary, H. R. Roth, 57 Bloor St. W., Toronto, Ont.

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Pacific Northwest: Organized, 1928. Headquarters, Seattle, Wash. Meets, Second Tuesday. President, R. E. Le Riche, 6345 39th S. W., Seattle 6. Secretary, C. W. Finn, 320 8th Ave. N., Seattle 9.

Philadelphia: Organized, 1916. Headquarters, Philadelphia, Pa. Meets, Second Thursday. President, M. G. Kershaw, DuPont Bldg., Wilmington, Del. Secretary, J. W. McElgin, State Rd. and Rhawn St., Philadelphia 36.

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Rocky Mountain: Organized, 1944. Headquarters, Denver, Colo. Meets, First Wednesday. President, F. L. Adams, P. O. Box 840, Denver 1. Secretary, J. J. Johnson, 1010 17th St., Denver 2.

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St. Louis: Organized, 1918. Headquarters, St. Louis, Mo. Meets, First Tuesday. President, B. C. Simons, 4030 Chouteau, St. Louis 10. Secretary, W. A. Russell, 7918 Kingsbury Blvd., Clayton 5, Mo.

South Texas: Organized, 1938. Headquarters, Houston, Tex. Meets, Third Friday. President, B. P. Fisher, P. O. Box 92, Houston 1. Secretary, C. C. Quin, 809 Stuart Ave., Houston 6.

Southern California: Organized, 1930. Headquarters, Los Angeles, Calif. Meets, Second Wednesday. President, Art Theobald, 116½ S. Kings Rd. Secretary, R. S. Farr, 2615 Southwest Dr., Los Angeles 43.

Southwest Texas: Organized, 1946. Headquarters, San Antonio, Tex. President, F. C. Benham, Jr., 702 S. Flores St., San Antonio. Secretary, L. S. Pawkett, 810 Insurance Bldg., San Antonio 5, Tex.

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Utah: Organized, 1944. Headquarters, Salt Lake City, Utah. Meets, First Wednesday. President, E. V. Gritton, 2470 S. 15, Salt Lake City 5. Secretary, C. E. Ferguson, 838 Garfield Ave., Salt Lake City.

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Virginia: Organized, 1946. Headquarters, Norfolk, Va. President, R. C. Thomas, 819 Westover Ave., Norfolk 7. Secretary, J. F. Reynolds, Gatling and Marble Ave., Norfolk 2.

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Washington, D. C.: Organized, 1935. Headquarters, Washington, D. C. Meets, Second Wednesday. President, L. B. Nye, Jr., 1100 H St., N. W., Washington. Secretary, J. N. Stewart, 6124 32nd Pl., N. W., Washington 15.

Western Michigan: Organized, 1931. Headquarters, Grand Rapids, Mich. Meets, Second Monday. President, J. W. Miller, Route 5, Box 498, Lansing. Secretary, K. E. Robinson, 211 Smith Ave., Lansing 10.

Western New York: Organized, 1919. Headquarters, Buffalo, N. Y. Meets, Second Monday. President, Herman Seelbach, Jr., 45 Allen St., Buffalo 2. Secretary, F. J. Weber, 443 Delaware Ave., Buffalo 4.

Wisconsin: Organized, 1922. Headquarters, Milwaukee, Wis. Meets, Third Monday. President, E. W. Gifford, 611 N. Broadway, Milwaukee 2. Secretary, B. M. Kluge, 1817 S. 66th St., Milwaukee 14.

Student Branch

Texas A. & M. College: Organized, 1946. Headquarters, College Station, Tex. Meets, Third Thursday. President, Herbert M. Kay, Texas A. & M. College, Box 2336. Secretary, G. H. Jackson, Texas A. & M. College, Box 2737.

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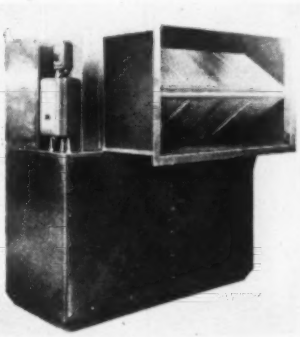
Expands Line To Include Conditioners



No. 3419*—The R. B. Rogers Companies, Inc., 1120 Leggett Ave., New York City, manufacturers of chemical dehumidification equipment and industrial cooling towers, is expanding its line of products in the air conditioning, heating, cooling and ventilating fields. New products now in production include self-contained air conditioning units from 3 to 25 ton capacity.

Of the package type, each air conditioning unit is assembled complete and ready for operation, requiring only the necessary service connections (water and electrical). One of the basic features of these units is said to be compactness. For example, the 10 ton size (shown here) has a depth of only 30 in.

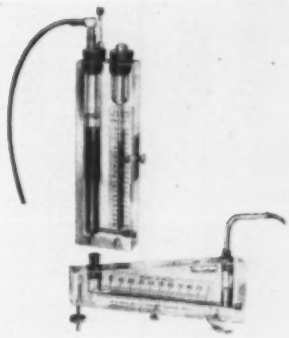
All products will be sold to heating, ventilating and air conditioning contractors, and the company's staff of sales engineers will be available to architects and engineers in specification work. National distribution will be handled through the company's branch offices.

New Solid Adsorbent Has Many Industrial Uses

No. 3420—Socony-Vacuum Oil Co., Inc., Lubricating Dept., 26 Broadway, New York 4, N. Y., has developed an industrial adsorbent "S/V Sovabead," which is said to be suitable for use in industrial drying, air conditioning, and many applications in connection with preventing corrosion and product spoilage.**

It is a chemically inert, solid siliceous material in the form of small beads which are said to be of uniform size and shape. In addition to its ability to adsorb many gases, the material will adsorb water vapor selectively, and may be reactivated by heating. It is said to be suitable for the same applications for which many other commercially available desiccants are used, but in addition, has the advantages of high adsorption capacity (approximately 39 per cent of its weight at 80 per cent RH), uniform shape and particle size, less dusting, rapid heat transfer, relatively small resistance to air flow, and efficient regeneration. According to the manufacturer, it opens new design possibilities because it can be circulated continuously with small attrition loss. It meets Army-Navy specification JAN-D-169, Grade A desiccant.

Testing Instruments Have Plastic Bodies



No. 3421—A new line of combustion testing instruments including portable and stationary transparent CO_2 indicators, draft gages, manometers and accessories, has been developed by the F. W. Dwyer Mfg. Co., 317 S. Western Ave., Chicago 12.

The Model 800 transparent CO_2 indicator, according to the manufacturer, gives complete visibility, exceptional accuracy, and simplicity of design so that an inexperienced operator can make accurate tests. The body of the instrument consists of a solid block of clear plastic which is not affected by the bright red indicating solution. All metal parts are of stainless steel.

The Model 100 portable draft gage, also of transparent plastic, is designed to measure all types of air velocities, drafts, and slight pressure changes. Light is admitted from all sides, leaving every part completely visible. Scale graduations extend 5 in. with more than 1 in. of sliding adjustment. Draft indication is said to be continuous and all fluctuations may be observed while adjustments are made.

Fins Bound Integral with Copper Tubing

No. 3422—Doyle & Roth Mfg. Co., Hawkins St. at CRR of N. J., Newark 5, N. J., is now manufacturing an all-copper finned tubing designed for a wide variety of applications.

The copper fins are wound and bound integral with the tubing, which is available in sizes from 3/8 to 1 1/8 in. O D. Two series of fin spacings are in production, the "Lo-Fin" spacings being from 14 to 22 fins per inch and the "Hi-Fin" spacings being from 2 to 8 fins per inch.

(*Continued on page* 164)

Heating, Piping & Air Conditioning [4-47]

6 N. Michigan Ave., Chicago 2, Ill.

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in Equipment Developments and Recent Trade Literature.

(Circle each number in which you are interested)

3419 3420 3421 3422 3423 3424 3425 3426 3427 3428
3429 3430 3431 3432 3433 3434 3435 3436 3437 3438
3439 3440
6471 6472 6473 6474 6475 6476 6477 6478 6479 6480
6482 6483 6484 6485 6486 6487 6488 6489 6490
6491 6492 6493 6494 6495 6496

Name..... **Title**.....

Company .....

Address .....

City..... **Zone**.... **State**.....

TO HELP YOU SELL!

A CONSUMER PROGRAM

You'll want full particulars about this first I-B-R promotional program directed to the consumer to help *you* sell more radiant heating. We're proud to have had a part in making this program possible, and we believe that you will want to take full advantage of the acceptance this campaign is building . . . *right in your own neighborhood!*

FREE BOOKLET

Write to the Institute of Boiler and Radiator Manufacturers, 60 E. 42nd St., Dept. NR, New York 17, N.Y. for free booklet and full details.

SOUND SALES TRAINING

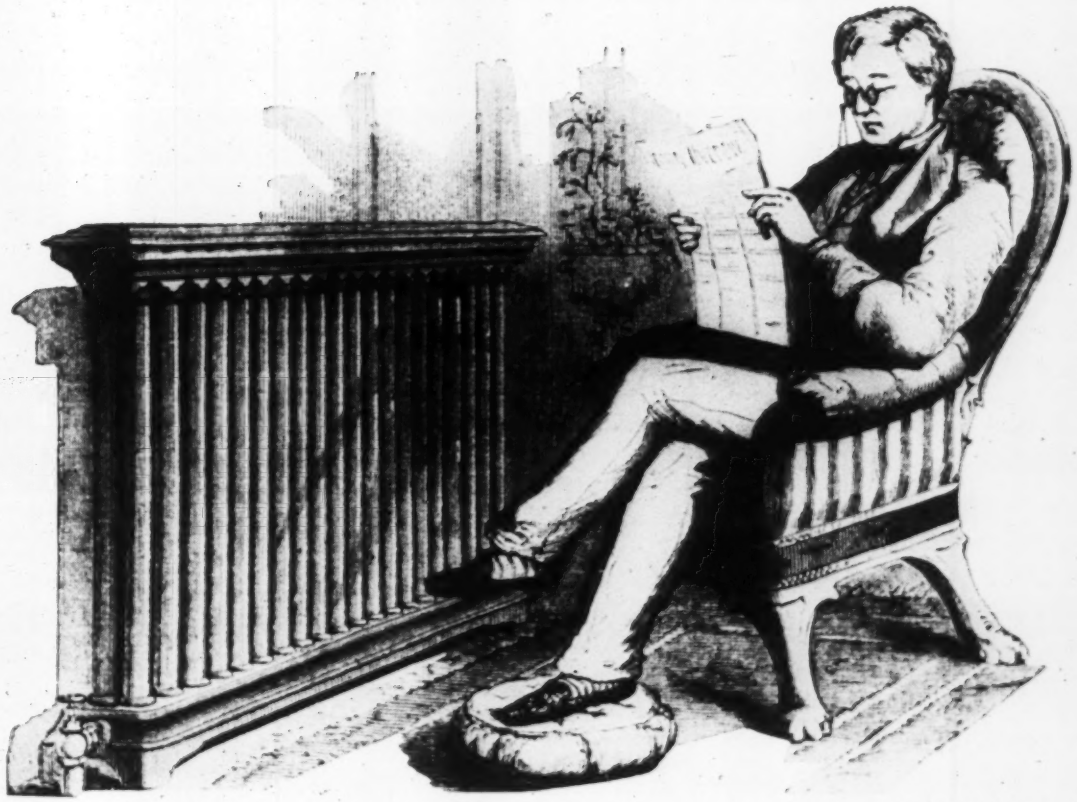
Here's an opportunity to sharpen up your selling tools for the competitive market that's bound to come. Solid, down-to-earth selling information in five interest-packed assignments for Contractor-Dealers and their salesmen, only $12.50. An extra assignment for Wholesaler salesmen—only $4.00 additional. Call your nearest NRC office for full information, or write as follows:

WRITE TO Sales Training, The National Radiator Company, 221 Central Avenue, Johnstown, Pennsylvania, for full information without obligation.

NRC

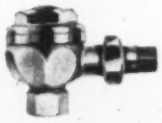
The NATIONAL RADIATOR Company

JOHNSTOWN, PENNSYLVANIA



FROM BETTMANN ARCHIVE

Newest Thing Out! . . . . . in 1873



LAST WORD IN 1947

The Marsh Radiator Trap and the Marsh Packless Radiator Valve are merely two good examples of a line of heating specialties that have set the standard for quality, value and dependability. The Marsh line includes float and thermostatic traps, inverted bucket traps, venting devices for all purposes, boiler gauges, dial thermometers, hot water circulators, control valves, indirect heaters and other heating specialties.

WHEN it first appeared, way back in 1873, this old print was played up as introducing the "Positive Circulating Vertical Tube Radiator". Eight years before it appeared, Jas. P. Marsh decided something should be done about this sort of thing, so he began to invent and manufacture one heating specialty after another, leaving the gentle art of making radiators in other and capable hands.

He originated and patented the first automatic air valves and thermostatic traps for heating systems . . . conceived and patented the first combination pressure gauge and thermometer . . . made endless contributions to heating specialties. Few men are left who remember Jas. P. Marsh, but no one can deny that the many basic contributions he made to heat distribution are absolutely indispensable to every modern heating system.

Such is the illustrious ancestry of Marsh Traps, Vents, Valves and other heating specialties. But far more important to you is the fact that the tradition of leadership started by Jas. P. Marsh still lives in the Marsh organization and the Jas. P. Marsh products of today.

To know how true this is, try out Marsh equipment and service on that next job. Remember that in addition to steam specialties, the Marsh line now includes a broad line of hot water specialties. Ask for facts about Marsh products and Marsh engineering service that goes with them.

MARSH HEATING EQUIPMENT COMPANY, 2061 Southport Avenue, Chicago 14, Illinois
Division of Jas. P. Marsh Corp.

MARSH *Quality Heating Specialties* **SINCE 1865**

Boilers made in 6 sizes
up to 3040 sq. ft.
E. D. R. steam.

ALDRICH
HEAT-PAK OIL BURNERS
AND BURNER-BOILER UNITS

. . . because the name, ALDRICH, means quality! It is a reputation attained after years of manufacturing experience, engineering leadership, designing skill. For conclusive proof of performance and efficiency on the job, Aldrich HEAT-PAK products were standard equipment in U. S. Insular Bases. Aldrich, the leading oil burner manufacturer, *guarantees* satisfactory performance!

Because Aldrich will not sacrifice standards of quality, production will be slow until the shortage of good materials is overcome.

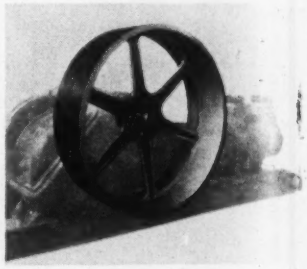
Model AX
.75 to 5.00 G.P.H.
Model BX
4.00 to 9.00 G.P.H.
Jumbo
5.00 to 19.00 G.P.H.

KNOWN and USED the WORLD AROUND!

ALDRICH COMPANY
WYOMING ILLINOIS

(*Continued from page* 161)

Reinforced Arms Used on Groove Belt Sheaves



No. 3423—Two new lines of QD sheaves, featuring improved groove-belt fit and reinforced arm construction, have been announced by Worthington Pump and Machinery Corp., Harrison, N. J.

Designated as the A and B lines, each will have individual groove sizes to match belt sizes. The reinforced arm construction incorporates a longitudinally ribbed arm recessed down the middle. The advantage of this type of arm, says the company, is that material is removed at or near the neutral axis and is added at points remote from the axis, where it gives the greatest strength.

Combines Expansion Valve and Suction Check

No. 3424 — Tenney Engineering, Inc., 26 Avenue B, Newark 5, N. J., has announced a combination suction check valve and expansion valve in one unit. This has been accomplished by incorporating a check valve in the company's TS-1 thermostatic expansion valve.

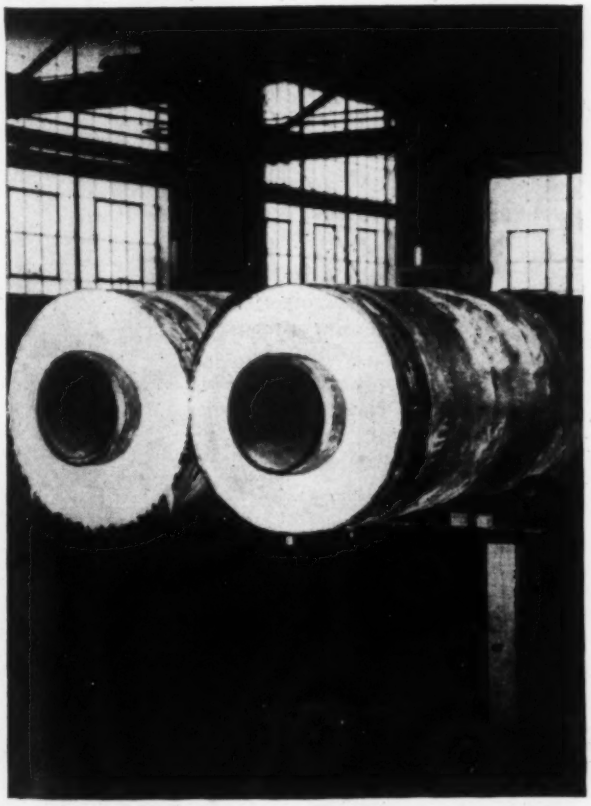
According to the manufacturer, one compressor can be used to serve two or more evaporators without the hazard of temperatures becoming equalized during machine shut down as the check prevents back pressure and bleeding suction vapor from a high temperature evaporator to a low temperature unit. It is stated that the compactness of the unit permits installations in confined spaces. Other features are said to include simplicity of construction, the elimination of a feeler bulb, instant response to suction vapor conditions, unusually close superheat control, and the elimination of any need for special "charges," and "cross charges" to assure operation in a specific temperature range.

Compound Inhibits Corrosion Due to Dissolved Carbon Dioxide

No. 3425*—"Morpholine," a volatile compound for inhibiting corrosion due to CO_2 in steam and condensate return lines of heating or processing systems, has been developed by Carbide and Carbon Chemicals Corp., 30 E. 42nd St., New York City.

The compound is an alkali which is designed to control acidity due to free CO_2 in the feedwater or CO_2 resulting from decomposition of soluble carbonates. It is said to evaporate with water in definite proportions so that any desired alkaline value in the steam generated can be maintained by adjusting the concentration in the boiler. It is recommended for feedwater treatment where extensive piping or condensing surfaces are present in low or medium pressure systems.

RIC-WIL PREFABRICATED UNITS FORM UNDERGROUND SECTIONS OF MILE-LONG TIE-LINE SUPPLYING 200,000 LBS. MORE STEAM PER HOUR WITH NO INCREASE IN BOILER EQUIPMENT



AT THE FACTORY: 10 inch extra heavy steel pipe in 21 foot lengths was covered with 3½ in. thick high-temperature insulation and encased in 16 gauge corrugated galvanized iron conduit.

● In the Rochester Gas & Electric Corp.'s new tie-line, steam is transmitted through the business district at 650 PSI, 750° F., one of the highest pressures ever maintained under city streets. Carried at this pressure for a distance of approximately a mile, the steam is fed through a desuperheating station and reduced to 250 PSI, 500° F. before entering the distribution system. With this tie-line, which utilizes excess steam capacity from one generating plant to serve additional customers of another, the utility company struck a happy balance between supply and demand. Service was extended without the necessity for new building construction or new boiler equipment. Ric-wiL Insulated Pipe Units, prefabricated at the factory to meet the specific requirements of this tie-line, provided ease and speed of installation.

If you have an underground or overhead pipe distribution problem, write for complete information.

RIC-WIL

INSULATED PIPE CONDUIT SYSTEMS

THE RIC-WIL COMPANY • CLEVELAND, OHIO

CABLE ADDRESS: RICWIL, BENTLEY'S CODE

Here's Your "Handful of Power" for Continuous Drilling

A Black & Decker Electric "HOLGUN"* is an easy drill to handle, weighs only three pounds, measures only 6¾" overall. Yet, this compact tool has abundant power for continuous drilling that saves time in all kinds of heating, piping and air conditioning jobs.

Drives twist drills up to ¼" . . . wood augers up to ½" . . . small wire brushes for cleaning and burnishing . . . B & D Hole Saws for cutting clean, round holes up to 1⅛" diameter in any material a hacksaw will cut. Ideal for working in hard-to-reach places. Requires less muscle to operate. Smooth housings, with famous "Pistol Grip and Trigger Switch," fit naturally into either hand.

Black & Decker Electric "SCRUGUNS"* are perfect team-mates for these drills to speed up many sheet metal assembly operations. Shaped just like the HOLGUN. Insure greater accuracy and uniformity with minimum operator fatigue. For full information on HOLGUNS, SCRUGUNS and many other Portable Electric Tools, see your nearby Black & Decker Distributor. Write for free catalog to: The Black & Decker Mfg. Co., 628 Pennsylvania Ave., Towson 4, Maryland.

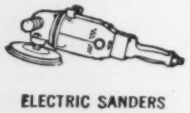
*Trade Mark Reg. U. S. Pat. Off.

LEADING DISTRIBUTORS EVERYWHERE SELL

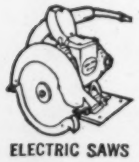
Black & Decker

PORTABLE ELECTRIC TOOLS

ELECTRIC DRILLS



ELECTRIC SANDERS

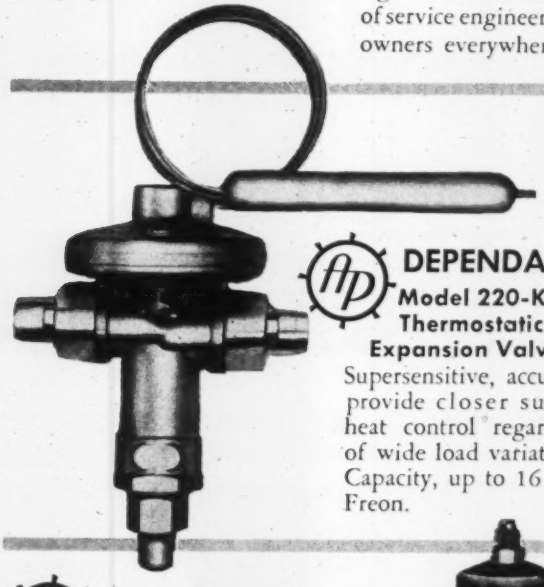


ELECTRIC SAWS

DEPENDABLE Refrigerant Valves

Help Reduce Service Attention on ANY Air Conditioning System

Good "service insurance" on any system, new or old, A-P DEPENDABLE Refrigerant Valves help you maintain peak efficiency with minimum service attention. Their operation on thousands of air conditioning jobs of every type prove this valuable advantage — for the benefit of service engineers and owners everywhere.



DEPENDABLE
Model 220-K Thermostatic Expansion Valves
Supersensitive, accurate, provide closer superheat control regardless of wide load variations. Capacity, up to 16 tons Freon.

DEPENDABLE
Water Regulating Valve Model 68-B
Maintains ideal, economical water-flow, condensing-pressure relationship. Adjustable. Operating head pressure range, 50 to 150 p.s.i. Has exclusive self cleaning feature that stops "dirt-and-lime" troubles.

WRITE for complete details on all A-P DEPENDABLE Refrigeration Valves:

Thermostatic Expansion Valves, Refrigerant and Water Solenoids, Water Regulating Valves, Suction Pressure Regulating Valves, "Trap-It" and "Trap-Dri" System Protectors and Cooling Thermostats.

AUTOMATIC PRODUCTS COMPANY
2460 North Thirty-Second Street, Milwaukee 10, Wisconsin
Export Dept., 13 East 40th Street, New York 16, New York

DEPENDABLE Refrigerant Valves
AIR CONDITIONING • REFRIGERATION • HEATING

Protects Superheaters on Naval Vessels

No. 3426—An electronic device for protection of superheaters has been developed by Bailey Meter Co., Cleveland 10, Ohio.

The unit consists of an electronic transmitter and an indicator. Its purpose is to warn firemen when steam flow through the superheater becomes dangerously low. This is accomplished by a red warning signal. A superheater high temperature alarm, utilizing a horn, may also be included with the system which is being used on various naval vessels such as the new Baltimore class cruisers.

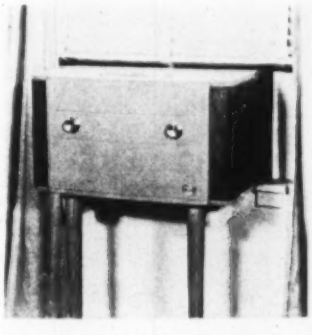
Controller Guards Steam Condensate Purity

No. 3427—Constant insurance against contamination of return steam condensate, particularly where steam is used for heating tanks or kettles, is the purpose of an electrolytic conductivity method that operates warning signals and even the valves direct to divert flow as desired. The method is simplified in the form of the "Solu-Bridge" controller, offered by Industrial Instruments, Inc., 17 Pollock Ave., Jersey City 5, N. J.**

The controller consists of two basic circuits: (1) an a-c wheatstone bridge, designed for operation directly from the usual 115 volt, 60 cycle line, with a cathode ray "eye" tube as the balance indicator which is said to be independent of line voltage fluctuations or vacuum tube characteristics; and (2) a self-contained single pole, double throw relay which reacts to the unbalance of the wheatstone bridge and delivers line voltage up to 2 amp, for operation of warning signals or electrically-operated valves.

In use the unit can be mounted at any convenient location in the plant and connected to the conductivity cell which in turn is mounted directly in the return line of the boiler. The relay terminals in the controller are wired to the solenoid or motorized valves located in the return lines at such points that, upon signal from the controller that contamination is present, the valves operate to divert the flow of condensate to waste. At the same time a bell or lamp may be operated to warn of the presence of contamination.

Conditioning Unit Fits All Types of Windows

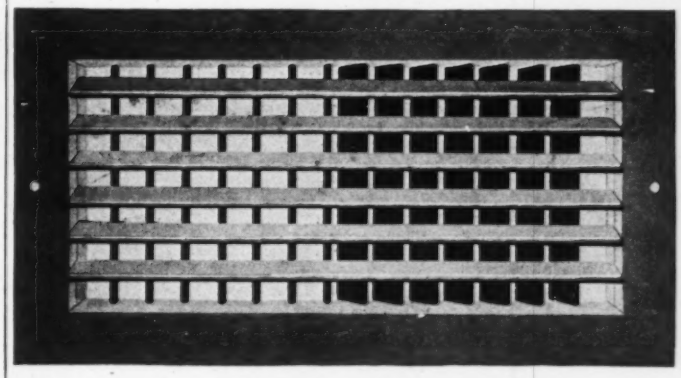


No. 3428—A new room air conditioner, designed for simple installation in any type window, has been developed by the Airtemp Div., Chrysler Corp., Dayton, Ohio. The heart of the unit is said to be the company's hermetically sealed radial compressor.

Operation is simplified by use of a single control on the front of the cabinet. By turning the knob to "fan" position, the cooler can be used for ventilating purposes when cooling is not required. A turn of the knob to "cooling" position operates both the fan

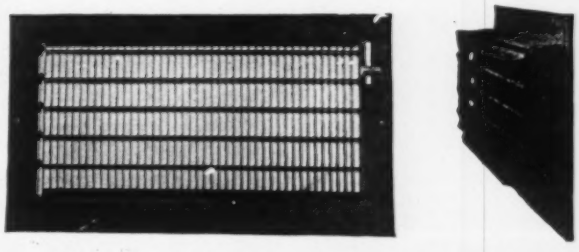
YOU CAN GET IT QUICKER FROM

STEWART



HIGH VELOCITY OUTLETS

Style DDH is one of 8 variations of Stewart High Velocity Outlets that can be supplied with or without volume valves. Each bar is adjustable with a key (furnished). This unit is a heavy attractive Outlet made in all popular sizes, with matching fixed-bar down-deflecting return grille. *HIGH VELOCITY OUTLETS CAN BE SUPPLIED TO FIT CONTOURS OF CABINETS FOR ROOM COOLERS.*



MULTIPLE DAMPER REGISTERS

For Wall or Baseboard

Style 74—Register. This Register utilizes 1" multiple-dampers to control volume and vertical direction. Multiple dampers may be set so as to obtain up, straight, or down deflection, as well as complete shut-off. The face is the same as all others of the "70" line—permitting air deflection right or left by adjusting front blades with key furnished. Blades are ¼" center to center, and ¼" in depth.

THE COMPLETE STEWART LINE

The Stewart line is competitively priced and consists of a wide variety of popular types and sizes (not shown) of High Velocity Outlets, Wall and Baseboard Registers, Diffusing Grilles and Radiator Fronts that meet most air-conditioning and heating needs. Construction is substantial and of cold rolled steel protected with a priming coat. Special types and sizes can be made to your specifications.

PROMPT DELIVERIES ON STANDARD MODELS.

"Ask for Bulletin and immediate quotation."

STEWART MANUFACTURING COMPANY

INCORPORATED

610 Bloomfield Ave.

BLOOMFIELD, N. J.

ADSCO

Engineered

for MODERN PROCESSING

Wherever industrial processes involve heating and cooling of liquids, ADSCO provides a complete line of horizontal and vertical heat exchangers. Available in a wide range of sizes built to standard and custom requirements and fabricated with ferrous and non-ferrous alloys. ADSCO engineers are at your service to aid in selecting or designing heat exchangers to meet your needs.

Write for Bulletin 35-76

AMERICAN DISTRICT STEAM CO.
NORTH TONAWANDA, N.Y.
MAKERS OF UP-TO DATE STEAM LINE EQUIPMENT FOR OVER 65 YEARS

and the compressor-condenser. According to the company this unit has unusually high capacity and can be directly plugged into the average 115 volt electric outlet. Overall height has been held to a minimum and the design is said to make the unit universally applicable to all types of windows.

A knob adjacent to the return air grille is used for adjusting the amount of outside air the user desires.

The design permits bringing this outside air in through the filter and then through the cooling coil, without first passing through the sections of the conditioner where it would pick up heat.

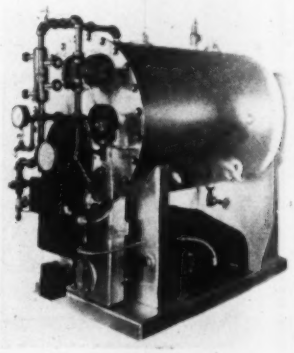
The interior of the cabinet is insulated and the unit weighs 196 lb.

Valve Cleans Coils by Reversing Water Flow

No. 3429—Cleaning hot water heater coils by reversing the flow of water and thus back washing is the purpose of the new "Clean-A-Coil" valve offered by Bell & Gossett Co., Morton Grove, Ill. Every time a faucet is opened, cold water enters through the valve and flows through the heater opposite in direction to the normal flow and thence into the tank.

When all faucets are closed, the water circulates in the usual manner, from the heater to the tank and back to the heater. When drawing water, the reversal of flow produces a back wash. This is said to provide turbulence which effectively cleans out sediment. The device is also said to be ideal for cracking off lime deposits where the temperature differential between the incoming cold water and the hot water is great.

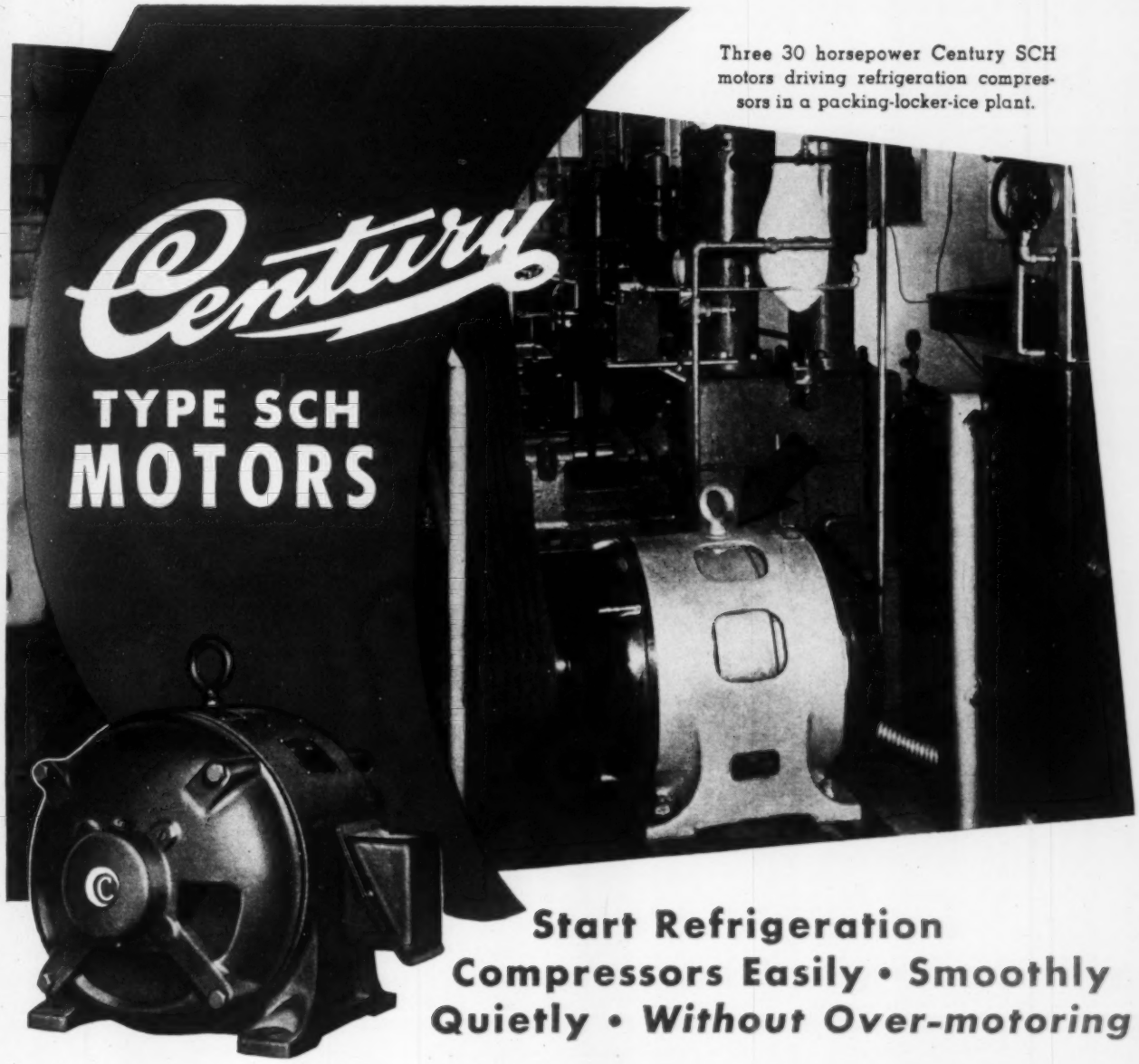
Steam Generator Has Two Pass Construction



No. 3430—Two pass, self contained steam generators in 10, 20, and 30 hp sizes are now in mass production at the plant of Preferred Utilities Mfg. Corp., 1860 Broadway, New York 23, N. Y. With a guaranteed thermal efficiency of over 75 per cent, the units are designed to burn No. 3 or lighter oil.

Units are built to ASME code requirements and are portable. Standard equipment includes a pressure type burner with electric spark ignition, fuel oil pump, induced draft fan, and the necessary controls for fully automatic operation. Also available for these generators are injectors, condensate systems, and metal clad boiler insulation.

Three 30 horsepower Century SCH motors driving refrigeration compressors in a packing-locker-ice plant.



Start Refrigeration Compressors Easily • Smoothly Quietly • *Without Over-motoring*

Refrigeration compressors under load are easily handled by Century SCH motors with high starting torque and low starting current. With this type Century motor it isn't necessary to over-motor the running load in order to get enough starting torque to start the compressor.

This often means that a motor with the next lower horsepower rating can be used when you select a Century SCH motor instead of a general purpose squirrel cage motor.

Century motors are built with rugged frames and accurately machined feet to assure solid mounting. They are well balanced mechanically and electrically. All these features and many others contribute to the smooth, quiet, dependable operation of Century motors.

There is a Century motor for every refrigeration, air conditioning and air circulating application. They are built in a wide range of types, in sizes from 1/6 to 400 horsepower. They are all engineered to the requirements of the machines they drive to assure top performance.

Specify Century for all your electric power requirements.

Century C MOTORS

506

CENTURY ELECTRIC COMPANY • 1806 Pine St., St. Louis 3, Mo.
Offices and Stock Points in Principal Cities

SYNCHRON

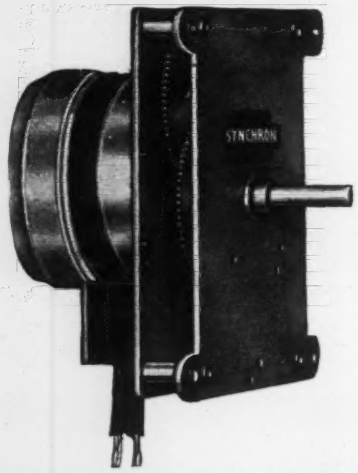
SYNCHRONOUS

SELF-STARTING

SELF-LUBRICATING

TIMING MOTORS

AND



SYNCHRON-POWERED, PRECISION-BUILT

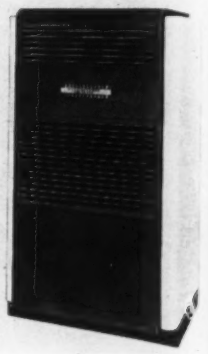
TIMING MACHINES

These power units are built to take it —with oil-impregnated double bearings, brass gears, hardened steel shafts—and a reputation for customer satisfaction that dates a quarter of a century.

SYNCHRON synchronous motors are small—only 2¾" by 1 5/16"—with power to pull 8 oz. direct load continuously at 1 RPM. This time-tested motor powers the SYNCHRON Time Machine, a compact little "timer" with a proved record for sustained accuracy and reliable service under all types of working conditions. For complete details, write

HANSEN MANUFACTURING CO., INC.
PRINCETON 6, INDIANA

Hermetically Sealed Compressor in New Unit



No. 3431—Manufacture of the newly-designed self-contained air conditioning "Unitaire" for installation in retail stores, shops, restaurants, and other commercial establishments has begun at the Sturtevant Div., Westinghouse Electric Corp., Hyde Park, Mass. The unit is made in 2, 3, and 5 hp sizes.

The new unit, reduced as much as 15 per cent in size as compared to prewar models with similar capacities, is said to be quieter, easier to service, and as much as 20 per cent lighter. The hermetically sealed compressor, condenser, evaporator, glass wool filters, and a fan for circulation are contained in the cabinet. A heating coil and humidifiers may be added to furnish year-round air conditioning.

Reinforced Tee Features New Line of Seamless Welding Fittings

No. 3432—A new line of seamless welding pipe fittings including elbows, return bends, straight and reducing tees, reducers, caps, lap joint stub ends, saddles, nipples, and crosses has been introduced by the Ladish Co., Cudahy, Wis.

Uniform wall thickness, accurate circularity, full effective radii, smooth inner walls, machined bevel ends, and improved metal structure are said to make the line distinctive. While designed and manufactured in accordance with ASA recommendations and other standards, the company claims many distinctive features, chief among which is a new tapered tee design incorporating reinforced center sections and crotch.

Uses Triethylene Glycol in Dehumidification System

No. 3433—A dehumidification system using triethylene glycol and composed of two basic units, an absorber and a concentrator, has been announced by R. B. Rogers Companies, Inc., Air Conditioning Div., 1120 Leggett Ave., New York City.

Designed to provide independent control of humidity and temperature, the system is said to be suitable for many industrial applications where the control of indoor temperature is relatively unimportant but where the control of humidity is essential. Under these conditions this system can provide the entire air conditioning. In addition, it can be used as a part of a complete air conditioning system, and when used on the fresh air requirements, it is said to provide reductions in installation and operating costs as well as provide independent control of humidity and temperature. Air sterilization is another advantage cited by the manufacturer.

Air to be treated is drawn into the absorber where the glycol is mixed with the air in the form of a spray and the mixture is cooled by means of water

Welding the Piping for a Coolant System

By R. H. Harvey, Maintenance Engineer
Thompson Products, Inc.
Cleveland, Ohio

CENTRAL supply systems for machining coolant, used in only a few of the biggest industrial plants prior to the war, are now being incorporated in many large factories. The systems at Thompson Products, Inc., Cleveland, involving 100,000 feet of piping, are among the most modern in the country and are now being enlarged.

In a central coolant system, instead of each machine having its individual coolant tank and pump, an extensive piping network conveys coolant from central storage, filtering and pumping facilities to machines throughout the factory, and return.

The Thompson Products piping is practically all of arc welded construction to minimize flow resistance, and to minimize construction and maintenance costs.

The largest coolant piping system at Thompson begins with a 90,000-gallon tank in a separate building. In one section of the tank, filters screen out the sludge, which collects at the bottom of the tank and is removed by a continuous drag chain conveyor. The filtered coolant in the clean compartment is gravity-fed through 10-inch pipes to the main pumps in the oil basement of the factory. There are four pumps, each of 2,000-gallons-per-minute capacity. Only two pumps are operated at once, the other two being spares. 40-50 pounds pressure is maintained.

Fig. 4. Welding 45° elbow to 3-inch pipe.

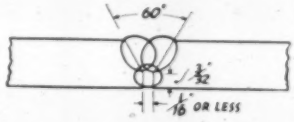


Fig. 2. Joint for 8-inch pipe.

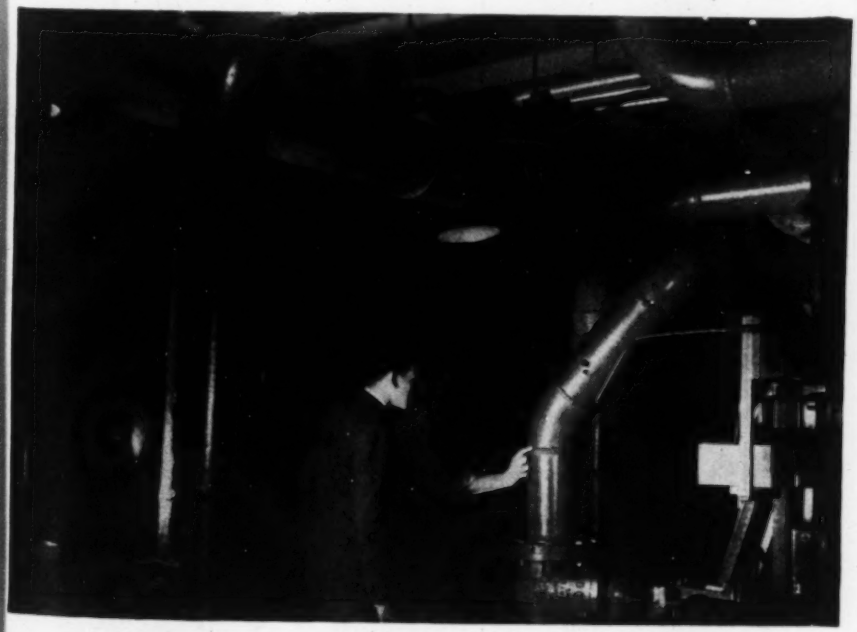


Fig. 1. Piping in oil basement.

Fig. 1 shows piping in the oil basement, including 8-inch piping which is the supply line from pumps to distribution piping in the plant. At left and top of picture are the 10-inch gravity-feed pipes to the pumps. The numerous bends were easily made by utilizing Tube Turns and arc welding.

Welding of the 8-inch pipe was done in three passes as sketched in Fig. 2. The 10-inch pipe was joined in four passes. Size 3/16" "Fleetweld 5" electrode and 150-170 amps. were used.

The supply and return pipes throughout the plant are 3 and 4-inch diameter. Supply piping is overhead. Return lines, now in the floor, are being converted to overhead to make rearrangement of machinery easier. Sump pumps—one for every four machines—will lift the sludge-laden coolant to the overhead return pipes, connecting from underneath at a 45-degree angle (see Fig. 3) to prevent clogging. The return pipes will be at a slight downhill angle so the sludge-laden coolant will flow by gravity back to the filtration tank.

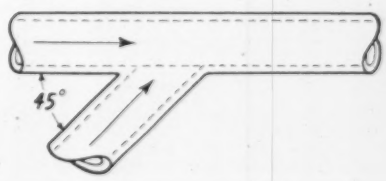


Fig. 3. Connection in return lines.

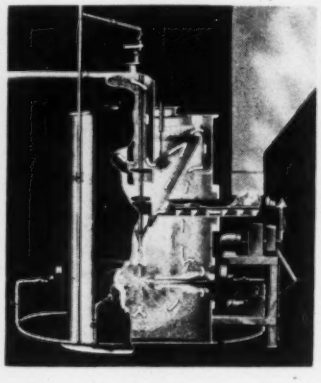
In Fig. 4 a 45-degree elbow is being welded onto a 20-ft. length of supply pipe, standard black steel of 3½ inches O.D. A 3-inch weld-neck flange has already been joined. Joints of 3 and 4-inch pipe are given a 75-degree bevel and welded in two passes with ⅛" "Fleetweld 5" electrode at 160 amps.

Complete procedures for welding all types of piping can be found in the "Procedure Handbook of Arc Welding Design and Practice", published by Lincoln Electric (price $1.50, postpaid). For a description of the book, write The Lincoln Electric Company, Dept. 471, Cleveland 1, Ohio.

Advertisement

coils which are designed to remove the latent heat of condensed water vapor. The concentrator is used to maintain the glycol concentration by removing the moisture condensed from the air being treated.

Superheated Steam Pulverizes Coal

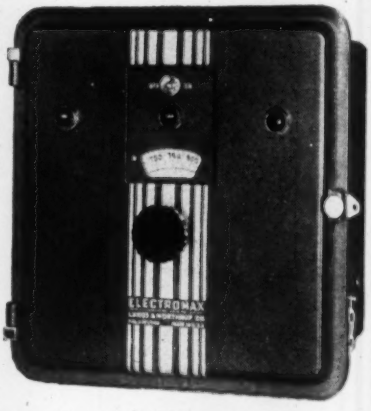


No. 3434—A new pulverizer developed by Blaw-Knox Co., Pittsburgh, Pa., for power and steam plants is designed to feed coal to boiler burners in a fluid stream. Known as the steam jet fuel pulverizer, it is produced in two models, a loop model and a circular type unit (shown here). This device has no moving parts, except for a screw drive that feeds fuel into the unit.**

Superheated steam at 700-800 F and 100 psi does the pulverizing. The powdered coal is then entrained by steam and delivered to the burners in a fluid stream, much like a gas. This is said to provide a high safety factor, to permit precise control, and to achieve very complete combustion so that smoke is reduced to a negligible quantity and fly ash is confined to mineral and unburnable residue.

Superheated steam is supplied by the company's superheater which is mounted either on top of the boiler or alongside the boiler, depending upon space limitations.

Temperature Control Signals, Controls Only

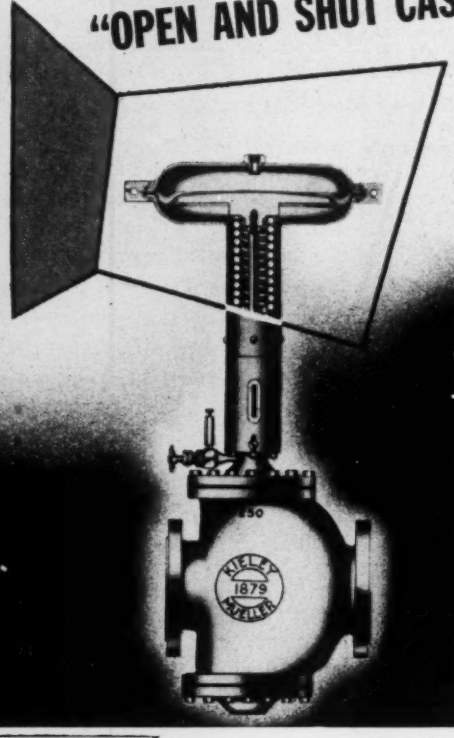


No. 3435—The "Electromax" is an inexpensive temperature controller designed by Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia 44, Pa., for use with ovens, stills, baths, presses, and coolants where indicating and recording are not required. The unit signals and controls only, though temperature readings may be taken manually.

The instrument consists of a wheatstone bridge circuit with a vacuum tube amplifier as the detector. The vacuum tubes are of a standard type, and the unit is a-c operated. According to the manufacturer, the lack of indicating and recording mechanism makes the unit practically free of maintenance.

The instrument case is approximately 11½x11x9 in. and can be mounted wherever convenient. Standard ranges are 0 to 250 F and 0 to 1000 F.

IT'S AN "OPEN AND SHUT CASE"



for K&M's Revolutionary

KONTROL MOTOR DIAPHRAGM VALVE

Just two simple quick-acting clamp screws to loosen, and your diaphragm casing is off. Tight-sealing clamp ring eliminates multiple bolts completely. Duo-seal molded diaphragm lips are automatically self-sealing.

67 years of control engineering "know how" produced this revolutionary new KONTROL MOTOR . . . featuring these design innovations:

- Pressed Steel Diaphragm Casing . . . lighter . . . tougher, more durable.
- Rigid Welded Steel *Tubular* Yoke.
- Long calibrated Steel spring . . . fully enclosed.
- Enclosed ball bearing Spring Adjusting Screw.
- Streamlined Flow Valve Body with high capacity . . . unrestricted flow areas.
- Super-finished Disc Guides, *honed* guide bushings, top and bottom . . . for minimum friction; increased life.

Used with air operated instruments or auxiliary pilot units, the K & M KONTROL MOTOR regulates the flow of steam, liquids or gases — efficiently and sensitively. Send us your control problems. We'll show you how the KONTROL MOTOR valves will solve them. Write for new KONTROL MOTOR bulletin.

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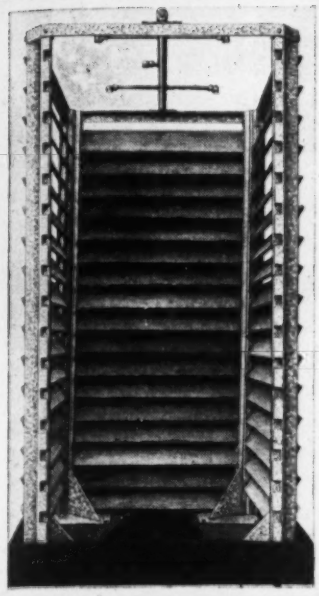
KIELEY & MUELLER, Inc.
North Bergen, New Jersey

30 STANDARD SIZES OF ATMOSPHERIC SPRAY COOLING TOWERS



Binks Type "S" Atmospheric Spray Cooling Towers are built in 30 standard sizes with capacities from 10 to 1200 G.P.M. This wide range of sizes enables you to fit your requirements without the added expense of a custom-built installation.

Binks Type "S" Atmospheric Cooling Towers are ideal for use where natural air movement is available. They are recommended for the cooling of condenser circulating water for refrigeration and air conditioning compressors and for use with all sorts of water-jacketed machinery and manufacturing processes where water cooling is used.

WRITE NOW FOR BULLETIN No. 800

Bulletin No. 800 is a fact-packed booklet describing completely Binks Type "S" Atmospheric Spray Cooling Towers. It is filled with specification data, engineering drawings, tables, illustrations, dimensions and suggested rating for various types of service. To simplify your calculations, a typical performance table is included. *Drop a postcard in the mail today for your free copy of Bulletin No. 800.*

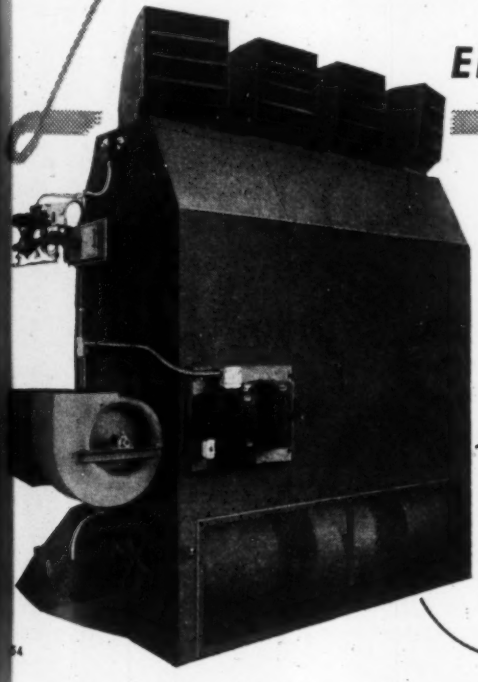
There is a Binks Cooling Tower for Every Water Cooling Job

BINKS MANUFACTURING COMPANY
3114-40 CARROLL AVE. • CHICAGO 12, ILLINOIS
OFFICES IN ALL IMPORTANT CITIES

AIRTHERM

DIRECT-FIRED WARM AIR HEATERS

Now Available
Either Gas or Oil Fired



Capacities from 650,000 to 1,950,000 B.T.U.

The Airtherm self-contained heater provides heat only where you want it — when you want it. It is not necessary to maintain fire during off-heating periods. The Airtherm Heater is always ready to provide heat at the command of the thermostat.

Write for Bulletin 801 describing this economical heater in detail.

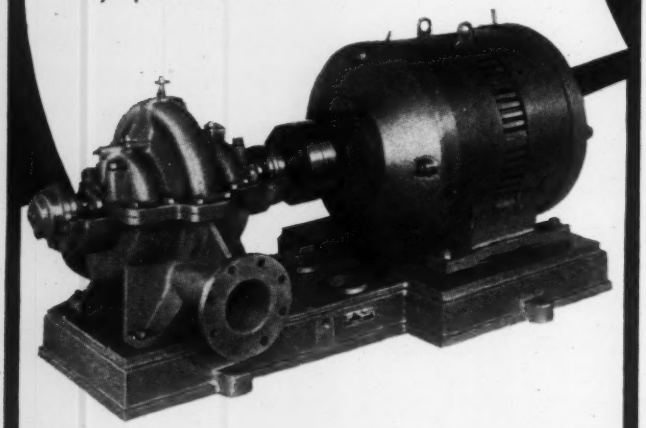
AIRTHERM MANUFACTURING COMPANY
711 South Spring Avenue St. Louis

Recognition

Recognition of the excellence of a product is not gained overnight . . . it is *earned* by the continual production of good quality, precision built equipment.

Weinman pumps have been used in the air conditioning industry for many years to the complete satisfaction of engineers and service men. The air conditioning industry knows from experience that Weinman pumps do a job efficiently, dependably and economically.

The Weinman Pump Manufacturing Company has gained this recognition through years of maintaining an unvarying standard of quality and performance. Centrifugal pumps are Weinman's only product, which permits the knowledge and skill of their engineers and mechanics to be devoted solely to pumps. This means that requests for service, for advice, for parts, for new pumps, always are answered quickly by qualified men.



Type L-1 Split Case Pump, direct-connected to motor. For circulation of cooling water over condensers and atmospheric condensers. Worn parts can be replaced without disturbing or disassembling any pipe connections.

More details on Type L Split Case Pumps are contained in Bulletin 627-1. Sent on request.

Built by Centrifugal Specialists

The WEINMAN Pump Mfg. Co.

COLUMBUS · 8 · OHIO

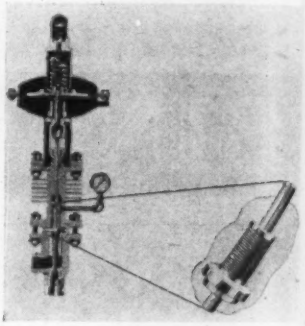
Combustion Principles of Jet Engine Used in Small Furnace

No. 3436—The "Jet-Heet" warm air furnace is designed by Kerns and MacCracken Corp., 103 Lafayette St., New York 13, N. Y., to utilize the combustion principles of the jet engine in burning fuel oil, to deliver up to 130,000 Btu per hr, and to measure less than 3 ft in length and 2 ft in height.**

According to the manufacturer, the stainless steel combustion chamber is about the size of a pint bottle. An electric ignition system is used, and Nos. 1, 2, or 3 oil may be burned.

The same blower is used to supply air for combustion and to deliver hot air to the spaces to be heated through small, flexible ducts made of glass fiber. An unusual feature of the system is the use of venturi type diffusers which draw return air from the room into a circulating duct where it is mixed with hot air and discharged back into the room through supply registers.

Eliminates Stuffing Boxes in Control Valve

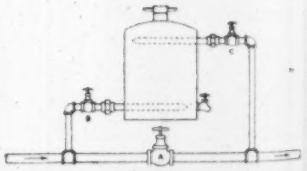


No. 3437—Hammel-Dahl Co., 243 Richmond St., Providence 3, R. I., has eliminated stuffing boxes in its 3000 B Series packless diaphragm control valves. The packless design can be applied to any size or type of the company's "Flo-tested" control valve for pressures up to 500 psi and temperatures from 70 to 750 F.

The bellows is housed in a unit assembly and replaces the conventional valve bonnet. The bellows unit is piloted into the valve body and is retained between two stainless steel gaskets by the bonnet assembly. It is protected from over ranging by travel stops. A modified packing gland is employed as an emergency seal should the bellows fail due to corrosion or as a result of mechanical fatigue, and a gage can be used, as shown here, to indicate a bellows failure. Standard bellows units are of stainless steel.

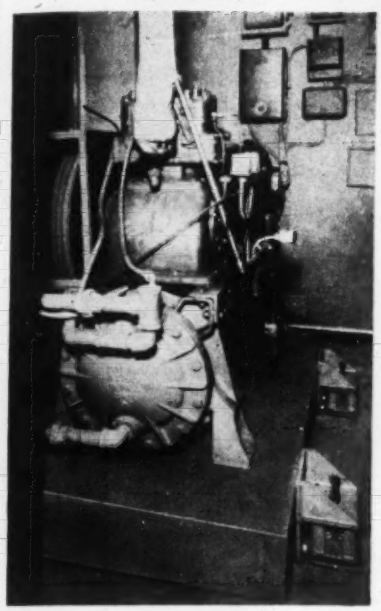
The manufacturer recommends this packless construction for handling toxic or dangerous fluids, for vacuum applications, where high vapor pressures are encountered, and where extremely valuable fluids are used.

Develops New Feeders for Corrosion Inhibitor



No. 3438—For commercial, institutional, or industrial establishments having corrosion or scale water troubles in hot water or cooling water systems, Calgon, Inc., Hagan Bldg., Pittsburgh 30, Pa., has developed a new series of "Micromet" feeders by which this chemical corrosion inhibitor is fed into water lines.

AIR CONDITIONING *Silenced* by KORFUND



ADJACENT to a broadcasting studio on the eighth floor of a New York building, this 2-cylinder, 2,050 lb. compressor unit with speed of 650 RPM, 10 HP motor at 1,700 RPM, is installed on 1,800 lb. concrete slab, and side-mounted on four Korfund LK/D Vibro-Isolators with Elasto-Rib pads. These support the entire unit with no disturbing vibration or noise transmission.

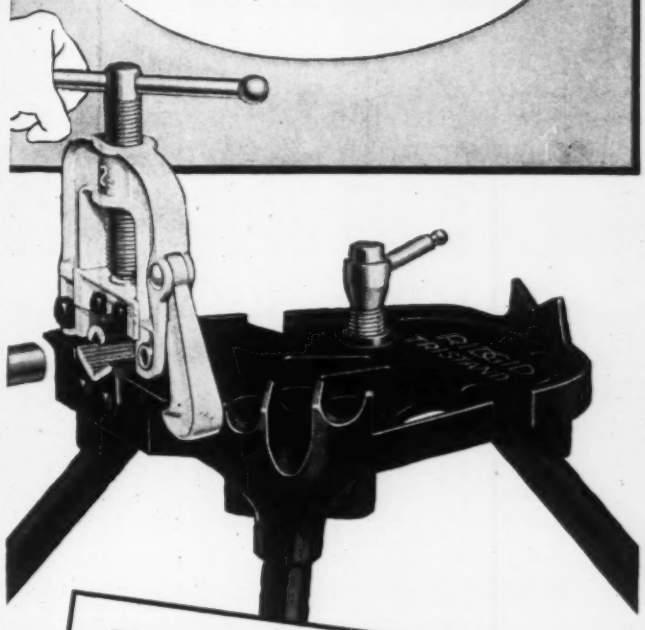
EVERYONE knows that broadcasting studios have to be quiet. And since most broadcasting studios today are air conditioned, Korfund Vibration Control must keep air conditioning noises *off the air*. Korfund meets this test of vibration and sound control with especially designed Vibro-Isolator Units.

Whether *your* air conditioning is in a restaurant, department store, hospital or theater, one of its benefits is quiet operation. Korfund Vibration Control is the answer to air conditioning operating disturbance. Contact Korfund today for a discussion of your vibration and noise transmission problem. No obligation, of course.

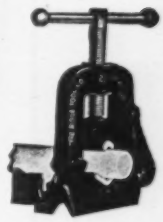
KORFUND
VIBRATION CONTROL

THE KORFUND COMPANY, Inc., 48-36 32nd Pl., LONG ISLAND CITY 1, NEW YORK

A PIPE VISE *That's a handy Work Bench*



RIDGID TRISTAND
is portable and roomy
—a big worksaver

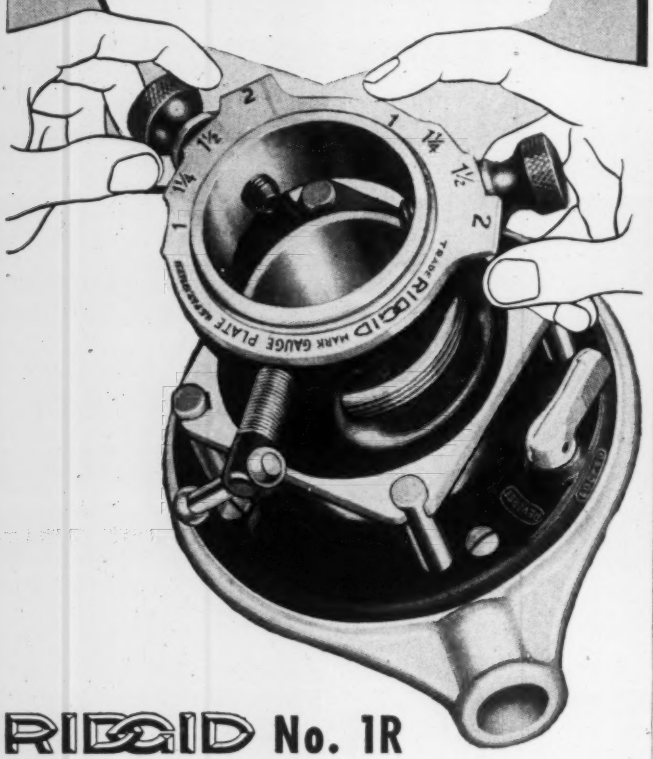


RIDGID
Vises include bench, post, stand models, yoke and chain.

● You can carry the Tristand easily to and around the job—legs fold in—and you've got a convenient work-bench. Big tray for dope pot, oil can, slots for tools, pipe rest for easier cutting and threading, 3 handy benders that won't dent pipe. Yoke or chain vise with LonGrip jaws, safe for nickeled pipe. A worksaver bargain—buy at your Supply House.

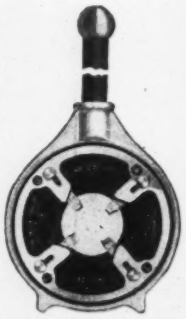
RIDGID
WORK-SAVER PIPE TOOLS
THE RIDGE TOOL COMPANY • ELYRIA, OHIO

THE *Easier Threading* POSTER DIE STOCK



RIDGID No. 1R gives you the popular time-saving plate-type workholder

● Prefer a poster-threader? Here's the one that's ready to thread 1" to 2" pipe quickest, with least fuss — RIDGID No. 1R. Dies change as fast as any but the mistake-proof workholder sets to pipe size in a jiffy — no bushings to monkey with — only 1 screw to tighten on pipe. You'll like the direct threading action — no wabble. Long life steel-and-malleable construction. Popular price — ask your Supply House.



Stands up handily anywhere.

RIDGID

WORK-SAVER PIPE TOOLS

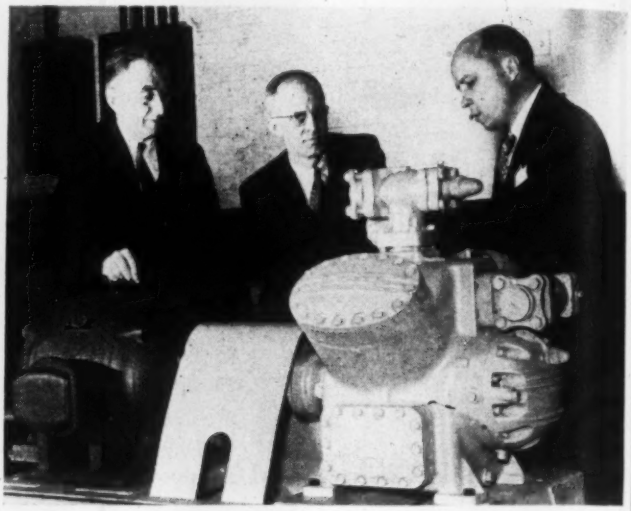
THE RIDGE TOOL COMPANY • ELYRIA, OHIO

The new series consists of large type feeders holding up to 20, 50, or 100 lb of the compound at one charge, and since the chemical dissolves slowly, only a small part of the initial charge needs to be renewed each month.

The water treatment, said to inhibit scale and corrosion without attempting to soften the water fully, is thus made available to all types of commercial and industrial establishments, including those having air conditioning systems where evaporative coolers and condensers tend to scale up or corrode.

New Refrigeration Compressors Coming Off Production Lines

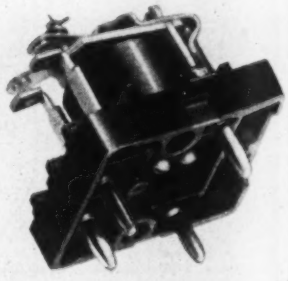
No. 3439—The new direct drive, four cylinder compressors are now rolling off the production lines at the Carrier Corp., 302 S. Geddes St., Syracuse 1, N. Y.



Shown here is a group of the company's production men looking over the first 5H40, a 25 hp unit. Features of the new line are said to include built-in capacity control, small space requirements, light weight, and low operating costs. The refrigerant is "Freon 12."

Small Magnetic Relay Has Plug-In Connectors

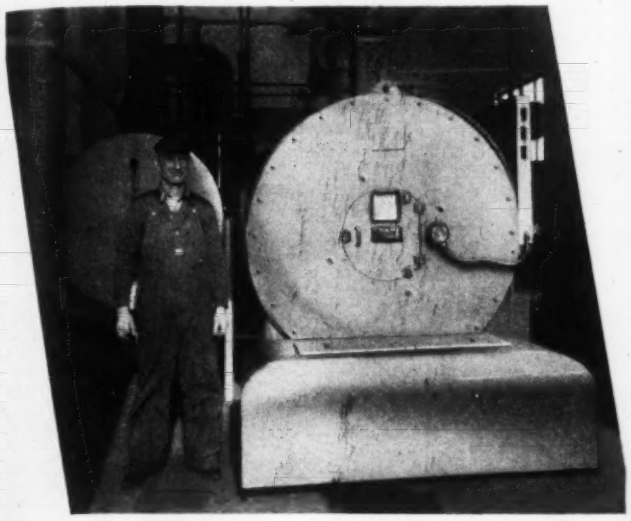
No. 3440 — Bulletin 106 midget magnetic relays are designed for application in industrial, electronic and special control circuits where remote or automatic operation is required. The manufacturer is Ward Leonard Electric Co., 31 South St., Mount Vernon, N. Y.



The relays, suitable for a-c or d-c on standard voltages and frequencies up to 125 volts, are available with single or double pole, and single or double throw silver contacts. Units are offered for two wire or three wire instrument control, and where enclosures are required, bakelite or steel covers, watertight boxes, etc., may be obtained.

The relays are provided with pin plug connectors, permitting mounting by plugging the unit in receptacles installed in the panelboard.

priceless quality
precision combustion



the ARCHITECT
the BUILDER
the CONTRACTOR
the ENGINEER
and most of all
the USER

ALL PREFER STEAM-PAKS

Why?—Because alone among all "packaged" steam plants built today, *Steam-Pak Generators* possess that in-built quality . . . that assurance of customer satisfaction . . . inherent in a York-Shipley product.

When you buy or specify a *Steam-Pak Generator*, you are getting a dependable product manufactured by the greatest name in oil heating—with exclusive advantages and really worthwhile features.

Today, low pressure *Steam-Paks* are being produced in volume in the 30, 50, 75, and 100 h.p. sizes. These are the ideal units for automatic heating or hot water production, in any known application. Industrial Division, York-Shipley, Inc., York, Pa.

Steam-Pak Generators are described in Catalogs ID-47-8C and ID-46-1C, yours on written request.

YORK-SHIPLEY

Oil-Fired Equipment for Industry

AMERICA'S MOST COMPLETE LINE

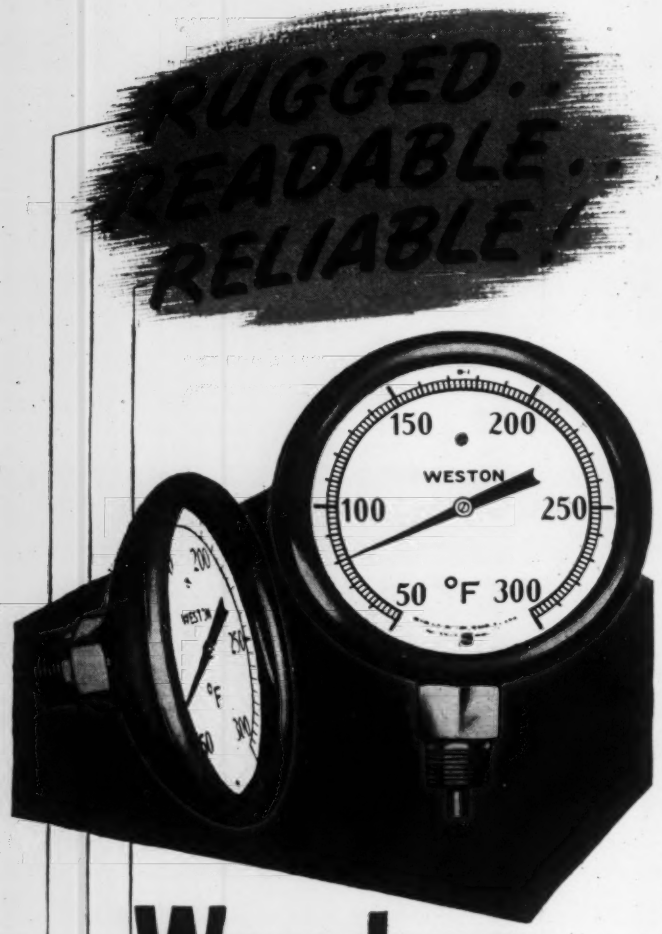
THE *Trouble-Free Worksaver* PIPE WRENCH

RIDGID is guaranteed against wrench housing repairs or expense

● What's that guarantee mean to you? That when you use RIDGIDS, you're practically free of wrench repair bother and expense, as millions of users know. Some day when you replace those positive-action jaws, the housing will be true as ever, adjusting nut will still spin easily to pipe size. With that handy pipe scale on hookjaw and comfort-grip I-beam handle you do more work with less effort with RIDGID. Buy at your Supply House.

End pattern for pipe in coils.

RIDGID
WORK-SAVER PIPE TOOLS
THE RIDGE TOOL COMPANY • ELYRIA, OHIO



Weston
All Metal
THERMOMETERS

- **RUGGED**—All metal construction withstands mechanical abuse encountered in the field.
- **READABLE**—Large dial-type scales readable in a jiffy, even from a distance.
- **RELIABLE**—No gases, liquids—no capillary connections; stays accurate far longer.

Available from stock for most industrial applications. If your jobber cannot supply you, see your local WESTON representative, or write... Weston Electrical Instrument Corporation, 648 Frelinghuysen Avenue, Newark 5, New Jersey.

MAX-MIN-MODELS also available, with auxiliary red index which indicates maximum or minimum temperature reached since last setting

WESTON *Instruments*

Equipment "Shorts"

To encourage the resumption of schoolhouse construction, John J. Nesbitt, Inc., of Philadelphia has established a policy of firm prices on all orders for the company's unit ventilators and related equipment whereby current prevailing prices are guaranteed on all orders placed for specific building projects and for which the purchaser agrees to accept delivery within 12 months.

The Hagan Corp., combustion and chemical engineering firm, has purchased the Ring-Balance Instrument Co. of Chicago, makers of recording, indicating, and totallizing meters for the measurement of steam, liquids, and gases. ..... During the recent heating and ventilating exposition in Cleveland, the Ric-wil Co. provided daily trips through its nearby Barberton, Ohio plant. Engineers, contractors, and executives were shown modern methods of fabricating underground and overhead prefabricated, insulated pipe units.

Worthington Pump and Machinery Corp., Harrison, N. J., has been awarded a contract by the General Petroleum Corp. for air conditioning equipment of 1000 tons capacity for a new office building in Los Angeles. Sears Roebuck has recently purchased a Worthington centrifugal unit for a store in Knoxville, Tenn.

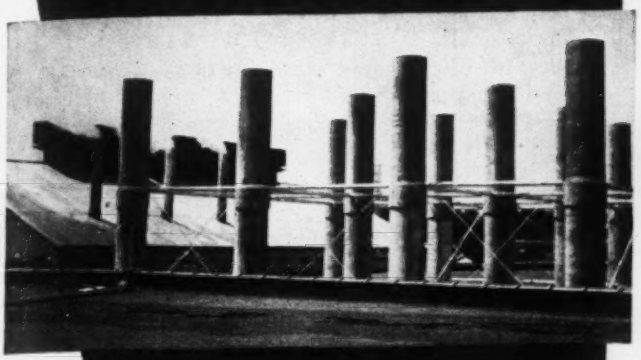
Plans of the General Engineering and Mfg. Co., St. Louis, for the opening of a second plant on adjacent property are nearing completion. The expansion is necessitated by the increasing production of the company's air conditioning units together with the forthcoming production of "Miracula" reverse cycle conditioning units. According to a recent announcement this unit, scheduled for September production, will use the earth as the heat source.

Sales of "Lithcote", corrosion resistant coating and lining material, have been taken over by the Bedford Development Corp., New York City, representing the Lithgow Corp. of Chicago. ..... According to a recent announcement, the Jas. P. Marsh Corp. of Chicago has declared a "firm price policy" in the sale of products such as pressure gages, thermometers, packless valves, traps, vents, and related steam heating specialties. Prices quoted during 1947 will not be increased above the prices in effect the date the order is placed.

A "snifter" unit, designed to show how activated carbon rids air of odor, was a featured display at the exhibit of W. B. Connor Engineering Corp., New York City, at the recent heating and ventilating exposition. Visitors sniffed jets of highly odorized air before and after passage through the "Dorex" filter medium. ..... Acquisition of the J. P. Danielson Co. factory in Jamestown, N. Y., for the manufacture of pliers and wrenches has been announced by the Plomb Tool Co. of Los Angeles.

Founded in 1939 to produce a sleeve bearing in which the lining is permanently "fusion bonded" to the backing or shell, the Evans Engineering Co., formerly of Milwaukee and now located in Waukesha, Wis., has been taken over by Magnolia Metal Co., Elizabeth, N. J. The Evans division will fabricate the bearing from metal furnished by Magnolia.

HOW TO CUT COSTS



in the venting of industrial gases, fumes, vapors

PLANT ENGINEERS in many industries are finding the answer to the problem of high-venting costs in Transite Industrial Vent Pipe.

That's because this durable asbestos-cement pipe is highly resistant to many of the corrosive fumes, vapors, dusts and gases met with in industrial operations. It is rustproof and requires no painting, whether used indoors or out. Moreover, it is light in weight and easy and economical to install.

Transite Industrial Vent Pipe is made in sizes up to 36" in diameter. A full line of Transite fittings provides corrosion resistance throughout the system.

Data Sheet DS Series 336 gives all the facts and is free on request. Write Johns-Manville, Box 290, New York 16, New York.

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Automobile	Furnace	Railroad
Baking	Furniture	Rayon
Bleaching	Gas	Refrigeration
Boiler Works	Glass	Rubber
Brewing	Laboratory	Shipbuilding
Canning	Laundry	Sewage Works
Ceramic	Leather	Shoe
Chemical	Meat Packing	Smelting
Dairy	Metal	Soap
Drug	Mining	Soft Drink
Electrical	Paint	Sugar Refining
Explosive	Petroleum	Textile
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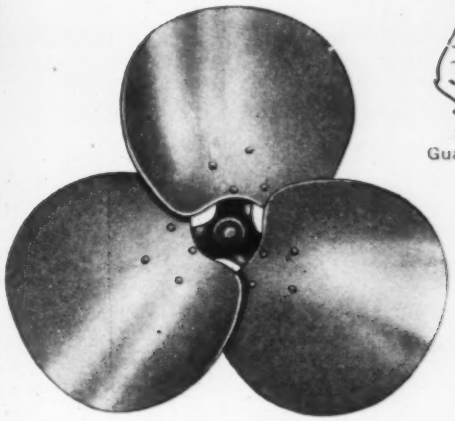

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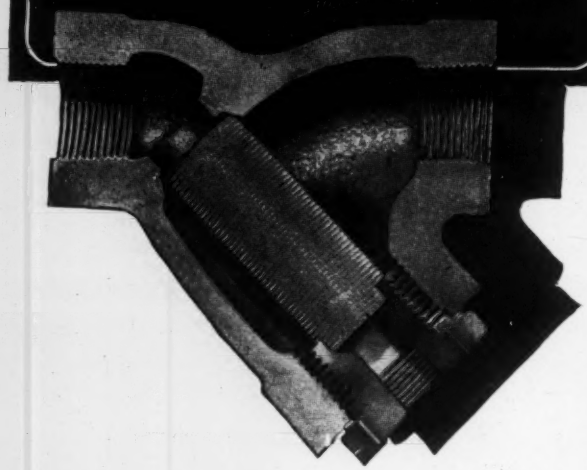

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NEW BOOKS & REPORTS

Covers Theory, Design Approximations for Panel Heating and Cooling Systems

As stated by the authors, B. F. Raber, professor of mechanical engineering and chairman, division of mechanical engineering, University of California, and F. W. Hutchinson, professor of mechanical engineering, Purdue University, the text, Panel Heating and Cooling Analysis, may well be divided into three sections, each of which presents a quite distinct phase of the subject of panel heating and cooling. The first four chapters present in admirable style and layman's language the story of man's attempts through the ages to attain greater comfort by regulating the heat loss of his body. The various heating systems of everyday experience and others not so commonly considered are brought into proper perspective. The second section of the book, consisting of seven chapters, develops the theory of radiant heat exchange and the mathematical analysis of radiant panel heating and cooling systems. Much of the theoretical and experimental analysis presented previously in technical journals by the authors is contained in this section. The third section consisting of chapters 12 and 13 presents simplifications of the rational design procedure developed in earlier chapters and discusses the degree of approximation involved in the various simplifications which are employed.

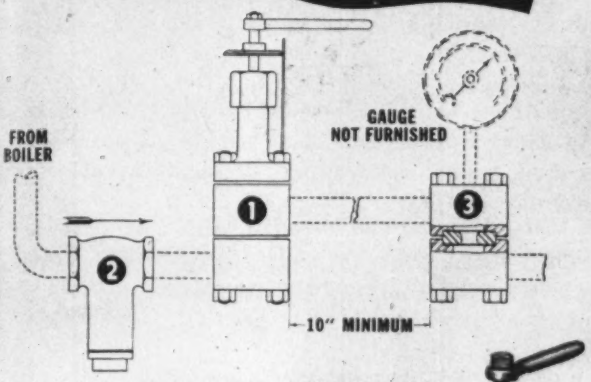
It is the authors' stated intent to supply background material in the early chapters, fundamental basic experimental and analytical data in the second section, and practical design methods in the third section.

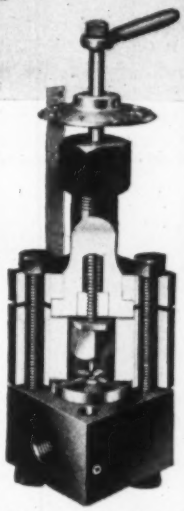
There can be no question of the success of the authors' efforts in the first section of the book. Casual readers and careful students alike should find this excellent material.

It is to be feared that the designer, who needs greatly a knowledge of basic material, will shy away from the rather lengthy analytical developments, detailed tabulations, and charts and will seize hastily upon well substantiated conclusions such as "In spite of its severe limitations, and the possibility of serious inaccuracy when applied in rooms that are geometrically unusual, the average surface temperature approximation to the mean radiant temperature possesses such an overwhelming advantage of simplicity that it is recommended for most practical design problems." Such shirking should not be substituted for diligent study which alone can justify the reader's acceptance of design methods presented later in the text. It is regrettable that the necessarily extensive mathematical treatment is complicated by the use of somewhat unorthodox methods in the three or four page development of the expression for the shape factor F when the use of elementary geometrical methods would suffice and at the same time be equally rigorous.

The final chapter introduces the concept of the equivalent conductance design procedure and it will be unfortunate indeed if the zeal of the authors, in attempting to provide the design engineer with "exact prototypes which he can readily follow," results in his following these examples without first securing a complete

Custom-Built... CONTINUOUS BLOWDOWN





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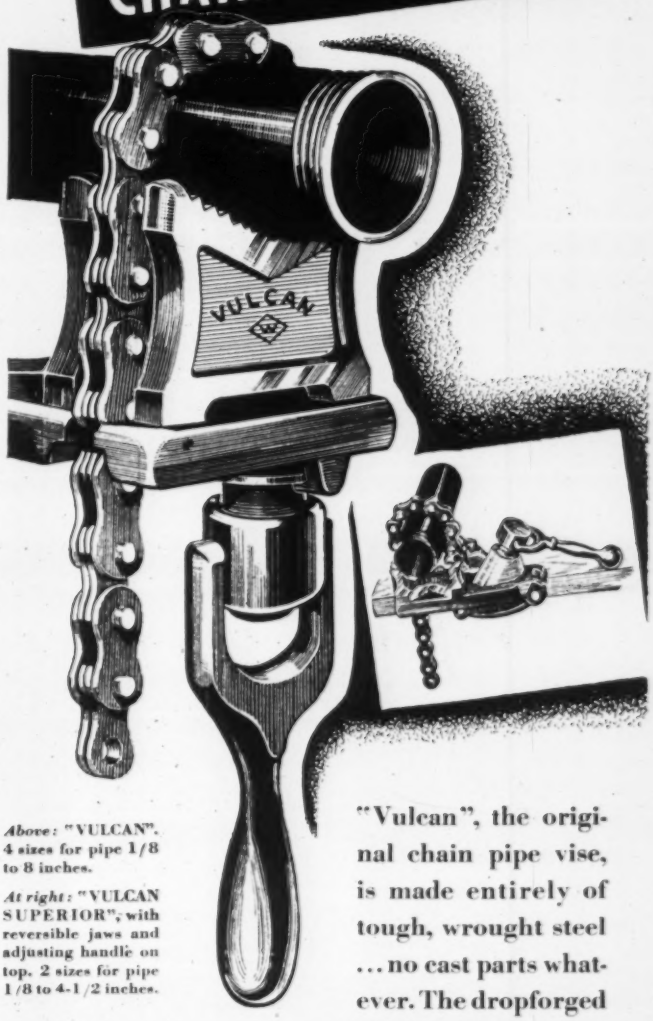

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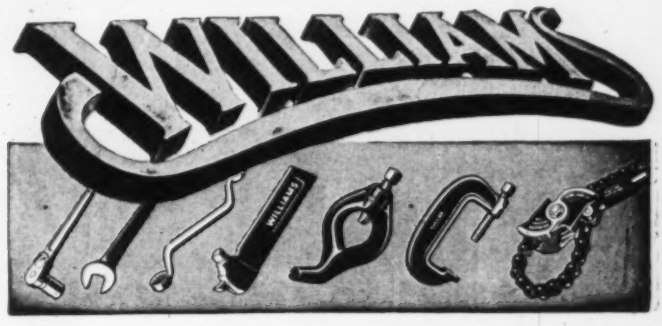

Mechanic for Robert A. Keasbey Company, New York City, installing ice water thickness Novoid Cork Pipe Covering on 12" lines of air conditioning system for Abraham & Straus, Brooklyn, N. Y., nationally known department store. The A&S store is shown as it will appear when new addition is completed.

YOU CAN NOW GET Novoid Cork Pipe Covering promptly through America's outstanding insulation contractors. In New York, the Novoid distributor is the Robert A. Keasbey Company, one of the oldest and most widely experienced firms in the business.

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understanding of the fundamental background presented in the second section of the book.

The serious reader and student will find in the text ample excellent material for study, which when thoroughly mastered, will give him a sound basic understanding of the theory of radiant heat transfer, the meaning of the mean radiant temperature, and the advisability of using the average surface temperature as a substitute for the mean radiant temperature. In addition, he will find tabulated and charted data on the shape factor for plane surfaces and the human body along with a thorough discussion of various approximations which may be employed in practical problems where the shape factor plays a significant role. He will become acquainted with the use of generalized heat balance equations as applied to the design of a panel heating or cooling system together with simplifications of these general equations.

Panel Heating and Cooling Analysis, published by John Wiley & Sons, Inc., 440 4th Ave., New York City, is cloth bound, contains 208 + vii pages (5½ x 8½ in.), and is priced at $3.50.—Reviewed by Warren E. Wilson.

Finds Mitre Bends More Susceptible to Fatigue

On the basis of comparable full scale fatigue tests for double mitre bends of given proportions, the stress intensifications at the corners are 20 per cent greater than for long radius welding elbows when bending moments are applied so as to open or close the bend. When the bending is done sideways, out of the plane of curvature, stress intensifications are 70 per cent greater. In term of fatigue life under identical conditions of pipe line expansion this means that welding elbows will withstand 2½ times as many stress reversals in the bending plane and 14 times as many cycles in bending transverse to the plane of curvature, as compared to mitre bends.

These findings are contained in a report, Fatigue Tests of Welding Elbows and Comparable Double-Mitre Bends, which was presented by A. R. C. Markl, chief research engineer, Tube Turns, Inc., at the recent Spring meeting of the American Society of Mechanical Engineers.

According to the author, test results also indicate that internal pressure has no marked effect on the magnitude of the stress intensifications encountered, and likewise, stress relieving and grinding the welds produces no significant change in the endurance strength.

Reprint copies of this eight page report may be obtained from ASME headquarters, 29 W. 39th St., New York City.

Presents Data on Testing of Bearings

The American Society for Testing Materials held a symposium on testing of bearings in order to make available latest information on the tests which are used, the equipment that has been developed, and the correlation of laboratory tests with field service.

The five technical papers comprising this symposium include one on life testing of plain bearings for automotive engines, by E. T. Johnson, engineering division, Chrysler Corp., a discussion by Thomas Barish on

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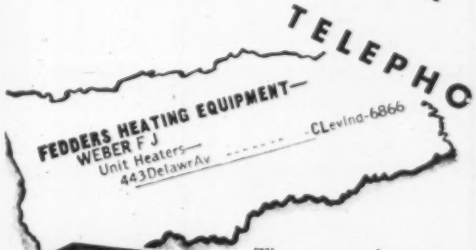

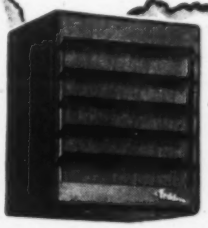

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fatigue testing machines for ball and roller bearings, and A. B. Jones of the engineering dept., General Motors Corp., has a contribution on metallographic observation of ball bearing fatigue phenomena. Two other papers cover fatigue testing of roller bearings, by H. R. Gibbons, Hyatt Bearing Div., General Motors Corp., and testing of bearings under controlled load, by J. M. Frankland and C. B. Innes, Chance Vought Aircraft Div., United Aircraft Corp. There are several pages of discussion in the form of questions and answers which add to the value of the booklet.

The 72 page publication, containing these papers, can be obtained from ASTM headquarters, 1916 Race St., Philadelphia 3, Pa., at $1.50 per copy.

Heat Power Text Emphasizes Energy Balance and Conservation

To develop an understanding of the functions, principles of construction, and actual performance of heat-power machinery, to provide an adequate and balanced terminal course for those who do not study engineering thermodynamics, and to provide a background for testing heat-power equipment are the purposes of a text, Elementary Heat Power, by H. L. Solberg, O. C. Cromer, and A. R. Spalding, all of Purdue University.

With the thought that a text should be arranged so as to stimulate student interest in the mastery of a basic course in thermodynamics, emphasis has been placed upon the energy balance and the law of conservation of energy. Numerous problems involving material and energy balances have been included as well as many problems on the calculations of machinery performance. Extensive use is made of the steam tables for determining enthalpy and specific volume.

This book is written for those who have completed a course in college chemistry, at least one semester of college physics, including heat and mechanics, and who have completed or are studying integral calculus. It is published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y., contains 480 +xiv (5¼x8¼ in.) pages, is clothbound, and is priced at $4.75.

Resistance Welding Manual Brought Up to Date

Revisions in the Resistance Welding Manual have practically doubled the size of the volume compared with the first edition. Twenty new chapters have been added. The tables of recommended procedures have been revised to bring them up to date with respect to present-day practice. Numerous additions, based upon research and experimental work conducted during the war production period, furnish operating data on materials not covered in previous editions.

In the section dealing with resistance welding procedures, each group of metals is treated in a separate chapter. The general plan of each of these chapters is a discussion of the resistance welding properties of the subject material, followed by explanations of the relative importance of the various operating variables and schedules of recommended welding conditions.

Published by the Resistance Welder Manufacturers' Association, 505 Arch St., Philadelphia 6, Pa., this 552 page book is cloth bound, and is priced at $3.00.

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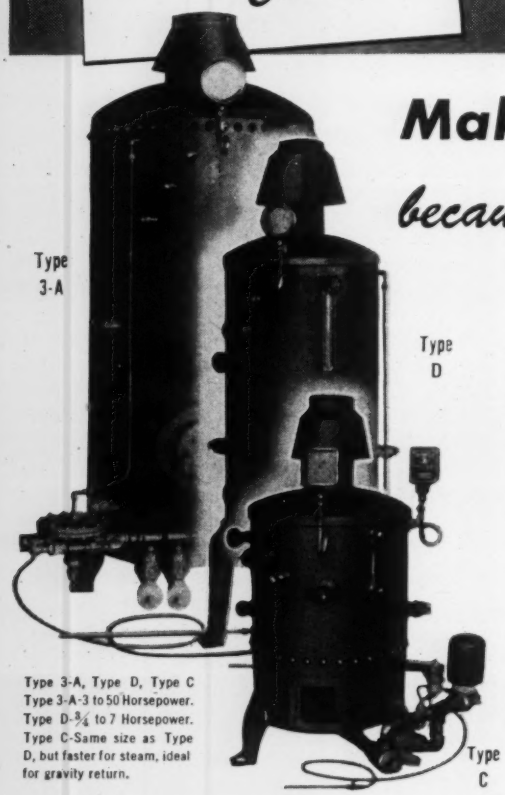

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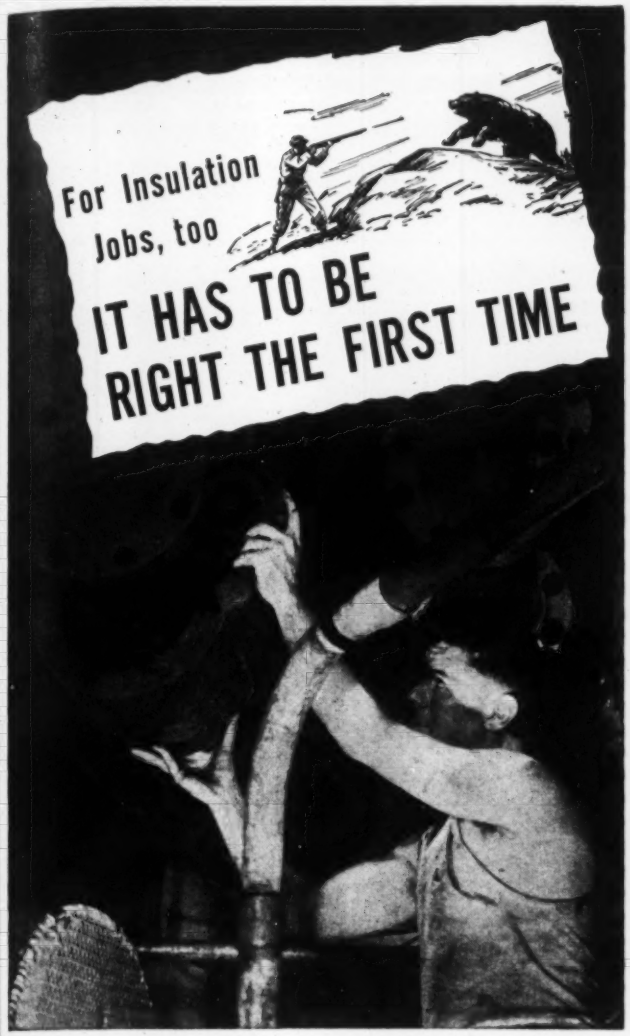

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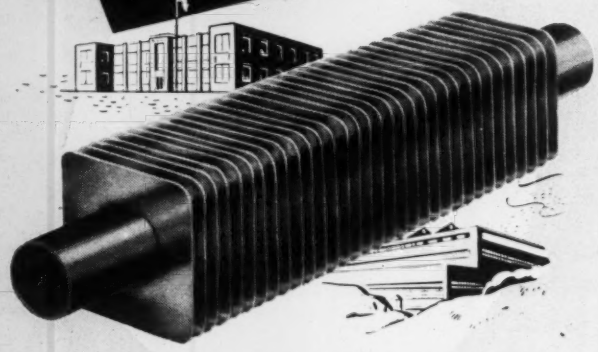

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MEETINGS & CONVENTIONS

Nine Technical Papers to Feature ASHVE Meeting

In addition to various committee meetings and social activities, the presentation of nine technical papers has been tentatively scheduled by the American Society of Heating and Ventilating Engineers for its semi-annual meeting, to be held June 2-4 at the Hotel Del Coronado, Coronado, Calif. (across the Bay from San Diego).

A. V. Hutchinson, 51 Madison Ave., New York 10, is society secretary and detailed information concerning the program, transportation, and hotel rates is contained in the ASHVE Journal Section of this issue.

ASRE Selects Los Angeles for 34th Spring Meeting

The 34th spring meeting of the American Society of Refrigerating Engineers, 40 W. 40th St., New York City, will be held in Los Angeles, Calif., June 9-11. This is the first national meeting of the society to be held on the west coast in 30 years.

The program for the three day session will include technical papers on hydrocooling and precooling, new developments in refrigeration lubricants, refrigeration in motion picture laboratories, and various aspects of food freezing.

Contractors Plan June Meeting

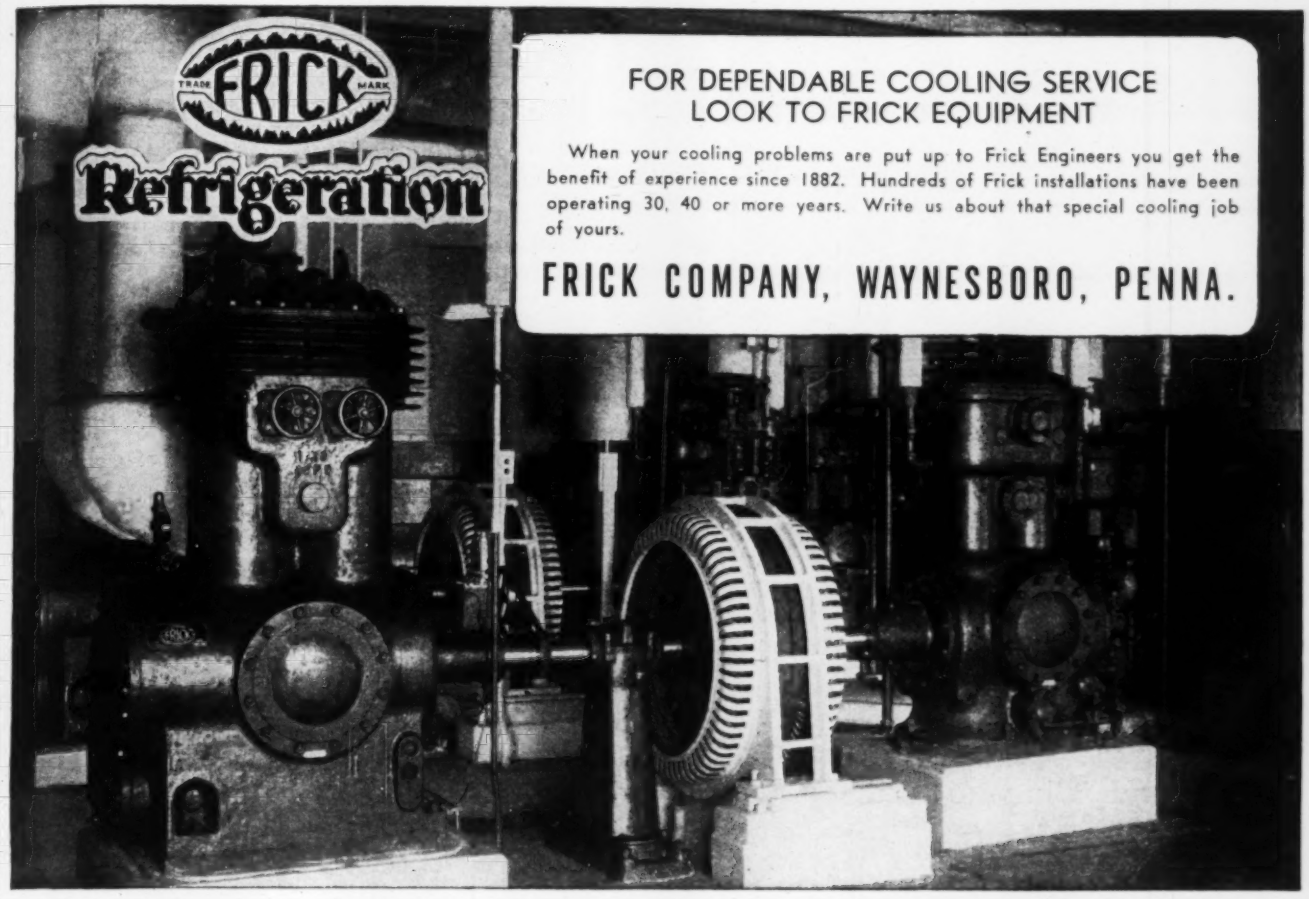
The Netherland Plaza hotel will be the headquarters of the 58th annual convention of the Heating, Piping, and Air Conditioning Contractors National Association. The meeting will be held in Cincinnati, June 11-14. Association headquarters is at 1250 Sixth Ave., New York City.

Many Technical Papers, Inspection Trips Planned for ASME June Meeting

Opening at the Chicago headquarters hotel, the Stevens, on Sunday June 15, the semi-annual meeting of the American Society of Mechanical Engineers will continue through Thursday June 19 with some 40 technical sessions, inspection trips, and entertainment features.

Technical sessions will start Monday morning. Six sessions will be devoted to power, four to management problems, three each to aviation, fuels, metals engineering, and oil and gas power. One or two sessions will be given over to heat transfer, industrial instruments and regulators, machine design, process industries, production engineering, engineering education, and citizenship. During the special session on problems of nuclear energy power generation, two papers will be given.

Some 750 rooms are to be set aside in the Stevens for ASME members and their guests, but the attendance is expected to exceed 2500, according to an announcement from society headquarters, 29 W. 39th St., New York City.



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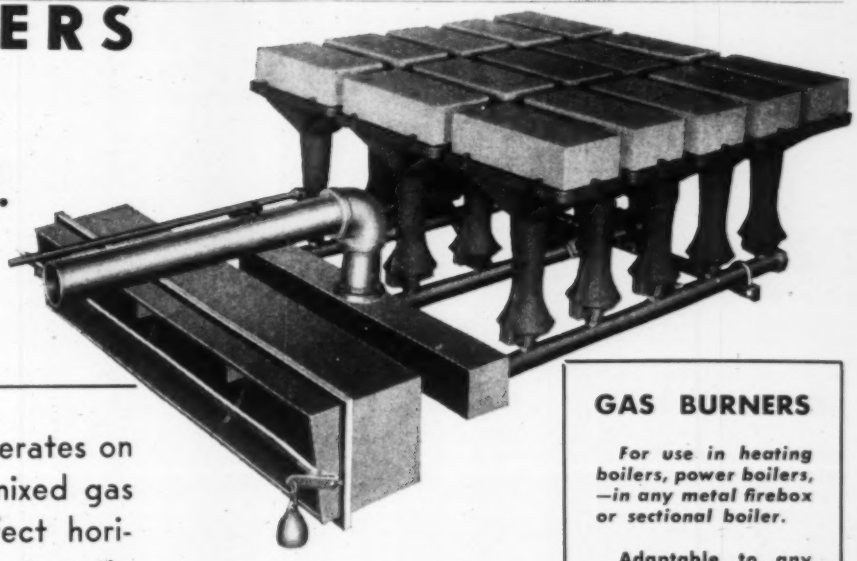

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Stoker Manufacturers to Meet in Tennessee

The Stoker Manufacturers Association, 307 N. Michigan Ave., Chicago 1, has selected Lookout Mountain hotel, Lookout Mountain, Tenn., for its annual meeting which will be held June 16-18.

NDHA Meeting Set for June 24-27

The 38th annual meeting of the National District Heating Association will be held at the Chalfonte-Haddon Hall hotel, Atlantic City, N. J., June 24-27. Association headquarters is at 827 N. Euclid Ave., Pittsburgh 6, Pa., and J. F. Collins, Jr., is secretary-treasurer.

Plan July Smoke Prevention Meeting

Arrangements have been made to hold the 40th annual meeting of the Smoke Prevention Association of America July 8-10, at the Royal York hotel, Toronto, Canada. Association headquarters is at 139 N. Clark St., Chicago 2.

British Exhibition to Feature Engineering Developments

The British Engineers Association, 32 Victoria St., London, S.W.I., England, has announced the 1947 Engineering and Marine Exhibition. This show is the first since 1937 in a long series and, according to the association, will "provide an opportunity of seeing all that is of importance in technical development over the past decade." The show will be held August 28 to September 13 in London's largest exhibition building, the Olympia.

Large Attendance Expected at West Coast Chemical Show

An industrial chemical conference and display for the western states and Pacific area are scheduled for the Civic Auditorium in San Francisco, Oct. 21-25. This is the first regularly scheduled Pacific Chemical Exposition and will be presented by the California section of the American Chemical Society, whose headquarters is at the Whitcomb hotel, San Francisco. According to a recent announcement, a record attendance is expected and over 40 per cent of the available exhibition space was booked in the first two weeks after floor plans were made available. Marcus W. Hinson is the exposition manager.

Atlantic City Choice of ASME for 68th Annual Meeting

The 1947 annual meeting of The American Society of Mechanical Engineers, 29 W. 39th St., New York City, will be held in Atlantic City, December 1-5. This will be only the third time in the society's history that it has held the largest of its national gatherings outside of New York City.

The Chalfonte and Haddon Hall, headquarters hotels, have guaranteed 2700 rooms for the meeting. Usually the attendance totals about 6000 but it is expected to exceed that figure this year.

ZINC

for LONG-TIME, LOW-COST PROTECTION AGAINST RUST

The U.S. Bureau of Standards, Circular #80, says, ". . . by far the best" protective metallic coating for rust-proofing iron or steel is ZINC. Zinc, in the form of galvanizing, protects against rust in TWO WAYS: First, by simple coverage, with a sheath of rust-resistant metal . . . Second, by electro-chemical action, or "sacrificial corrosion." That's why industry has long depended on ZINC to stop rust—cut costs—save materials. Heavy coatings pay—for the heavier the coating, the better the protection, the longer the service life and the lower the cost.

ZINC INSTITUTE 2 OZ. COATING SEAL OF QUALITY

The "Seal of Quality", shown above, is the yardstick of economy in buying galvanized sheets. It signifies at least 2 oz. of Zinc per square foot!

FREE BOOKLETS

WRITE TODAY for these valuable booklets; (1) Repair Manual on Galvanized Roofing & Siding (2) Facts about Galvanized Sheets (3) Use Metallic Zinc Paint to Protect Metal Surfaces.

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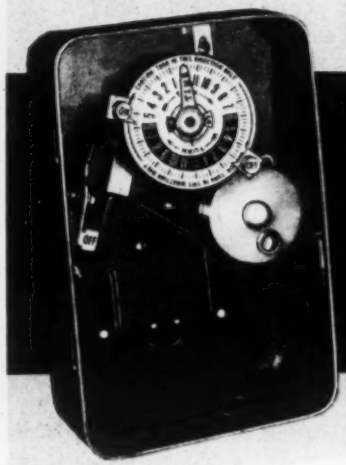

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Write for folder giving full details of this high quality Time Switch and names of nearest distributors.

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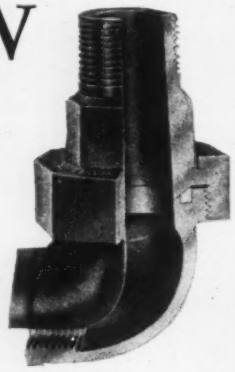
Easy to work with . . .

JEFFERSON Unions



Sure they're easier to work with! Jefferson Specialty Unions, such as this male and female union ell are constructed for maximum ease of installation while at the same time affording permanent protection against leaky joints and consequent annoying and expensive shutdowns. Once they're installed you're certain of a lifetime connection because of the recessed brass seating feature. You can't dislodge it by screwing pipe ends in too far and it gives a tight, leakproof joint. Get the details on our complete line. Write now!

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Established 1937
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OIL BURNER NOZZLES

RECENT TRADE LITERATURE

For your convenience in obtaining copies of these bulletins, see coupon on page 161. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending requests to Heating, Piping & Air Conditioning.

Air Conditioning Controls

No. 6471—Fulton Sylphon Co., Knoxville, Tenn., has issued a folder on the company's principal controls for heating, ventilating, and air conditioning. The various equipment items are briefly described and illustrated and a number of typical applications is shown.

Air Conditioning Recorder-Controller

No. 6472—The Model 725 recorder-controller assembly was developed by Friez Instrument Div., Bendix Aviation Corp., Baltimore 4, Md., to measure the temperature and humidity at eight remote stations, to record the data and the time at a central station, and to start or stop air conditioning apparatus. This control, when supervising humidity, is based on the average of the eight readings. The equipment and various applications are briefly described in a new four page catalog.

Suspended or floor type heaters for any size areas . . . for offices, stores, factories, warehouses, and commercial buildings. High yield heat exchanger tubes and big quiet fan distribute heat at less cost, less trouble. Investigate Reznor unit heaters.

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Gas fired unit heaters
SUSPENDED OR FLOOR MODEL
A SIZE FOR EVERY NEED
REZNOR CO. MERCER, PENNA.
GAS FIRED HEATERS SINCE 1888

NO BOILERS • NO STEAM LINES
NO FUEL STORAGE • NO FIRE TENDING

Air Filtration and Dust Control

No. 6473—Various types of industrial dust problems and typical applications of air filters manufactured by the American Air Filter Co., Inc., 215 Central Ave., Louisville 8, Ky., are contained in a new 23 page booklet. Included are a chart of sizes and characteristics of air-borne solids, together with sections dealing with atmospheric dust and filtered air for industrial air conditioning and ventilation, drying operations, product finishing, the control of bacteria and mold spores, and cooling electrical equipment, engines, and compressors.

Centrifugal Blower Wheels and Blower Fabrication

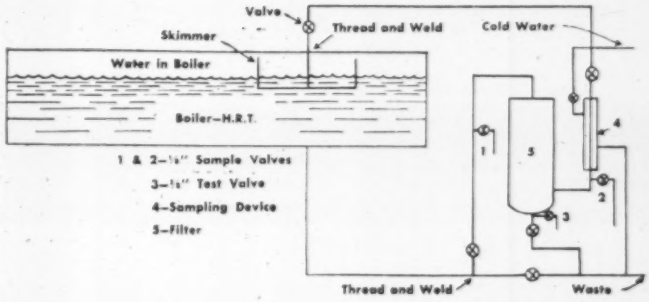
No. 6474—"Airstream" centrifugal blower wheels of the forward curved blade type are described and illustrated in bulletin No. 403 released by Morrison Products, Inc., E. 168th and Waterloo Rd., Cleveland 10, Ohio. The wheels consist of two pressed end rings with integral hubs and a one piece blade group (made from one strip of soft steel) which are spot-welded together. Housing sides, squares, and templates are also offered so that a complete blower can be assembled in a sheet metal shop. Bulletin No. 303 describes the company's engineering service designed to enable manufacturing customers to make complete assemblies using these wheels.

Chlorine, Soda, and Ash

No. 6475—Among the numerous compounds manufactured by the Pittsburgh Plate Glass Co., Columbia

It's **NEW!** *It's* **GOOD!**

RODWELL'S BOILER WATER FILTER
For HIGH or LOW PRESSURE BOILERS



Here's a simple and effective way to keep boiler water CLEAN. The Rodwell boiler water filter helps to eliminate the troubles caused by scale, pitting, etc., which sooner or later result in an expensive retubing job or new boiler.

The "Skimmers" (shown above) draw the sediment and scum from the top of the water, which passes through the Filter (#5) where all impurities and foreign matter are removed and the water returned fresh and clean to the boiler. No clogging or scaling troubles . . . and no long drawn out tube cleaning operations!

It will pay you to investigate this time and money saving device today. Just drop us a line. Franchises are available for responsible dealers.

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CLEAN CHEMICALLY WITH SAFETY

ALL HEATING SYSTEMS

RIDAL SERVICE guarantees to remove SLUDGE and all other foreign matter from your entire plant with harmless chemicals SAFELY and economically. RIDAL SERVICE restores to original operating efficiency your entire system—condensers, steam feed lines—condensate returns—water heaters—steam kettles—cooling and heating coils—traps, etc. We have cleaned thousands of difficult jobs successfully and guarantee complete satisfaction. We also sell the chemicals we use separately, without service. Get our consultation service without obligation.

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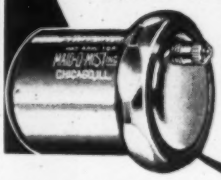
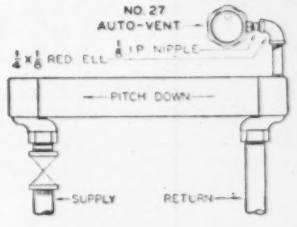


AUTO-VENT AIR ELIMINATORS REALLY DO A JOB!

As air accumulates in radiators or pipes, it is AUTOMATICALLY VENTED when you use these inexpensive No. 27s. Your customer gets better heating and saves fuel.

AUTO-VENTS work equally well on convectors, baseboard radiation, panels, radiant heating coils, etc. — NO AIR CHAMBER REQUIRED. Good for pressures to 50 lbs. *See your jobber, or write us direct.*



SIMPLE AS A-B-C

Detailed drawing of No. 27 Auto-Vent Air Eliminator operating on convector radiator. Auto-Vents used on other types of jobs are just as easily installed — and no attention required.

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HAYS offers a complete line of pointer type draft gages designed to fit every need and every budget.

No longer is it necessary to buy a large gage when a small one is available that will serve quite as well or better. No longer need you try to make one size gage handle all drafts.

All these gages have the famous Hays slack diaphragm unit for ranges of draft or pressure from 0 to 120 inches of water. For ranges above 100 inches, Bourdon Tubes are used. For full description of these better gages, in all sizes and ranges, send for Bulletin 45-667.

The HAYS CORPORATION

COMBUSTION INSTRUMENTS AND CONTROL

MICHIGAN CITY, INDIANA, U.S.A.

Chemical Div., Fifth Ave. at Bellefield, Pittsburgh 13, Pa., are soda ash, liquid chlorine, caustic soda, caustic ash, modified sodas, and sodium bicarbonate. Each of these products is described in new separate folders recently issued. These compounds are used in many industries for cleaning, bleaching, neutralizing acid, water purification and softening, and in the manufacture of boiler compounds. Each folder gives information on properties, compositions, and applications.

Control of Spreader Stokers

No. 6476—Bailey Meter Co., 1050 Ivanhoe Rd., Cleveland 10, Ohio, has issued bulletin No. 1022 on the control of spreader stokers. Data on automatic control layouts are given and the operation of component parts of the control system is explained. Also shown are charts illustrating the performance of a complete system with automatic fuel-air ratio control.

Corrosion Resistant Coatings

No. 6477—New application specifications have been issued by Prufcoat Laboratories, Inc., 63 Main St., Cambridge 42, Mass. Information on the preparation of metal and masonry surfaces as well as application procedures for the company's protective coating is given. The coating is recommended by the manufacturer for floors, walls, structural steel, pipe, tanks, ducts and machinery.

THIS AT-A-GLANCE OIL GAUGE IS 125 YEARS OLD!

IN POINT OF SERVICE

Based on 8 fillings for one year per oil tank, it would take 125 years of service to accomplish the record of this AT-A-GLANCE OIL GAUGE established in the Sentry Gauge Exhibit at the 7th International Heating and Ventilating exhibition at Cleveland, Ohio. *This record proves durability for all users of AT-A-GLANCE OIL GAUGES.*

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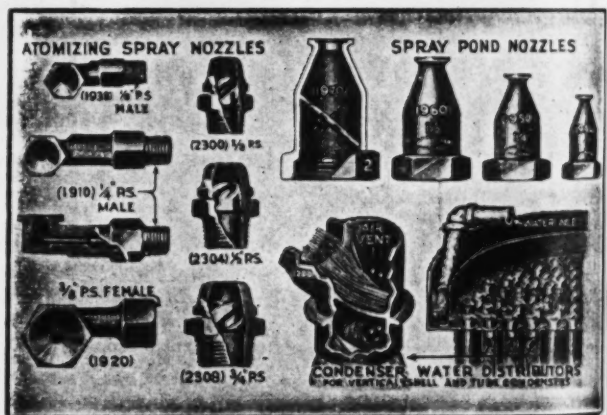
QUALITY MARTOCELLO Products are fully DEPENDABLE



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For Vertical Shell and Tube Ammonia Condensers

ALL MARTOCELLO SPRAY NOZZLES are manufactured with precision and of a design which has been thoroughly tested for maximum results and durability. They are guaranteed to give satisfaction. Successful, efficient results depend largely upon selecting the proper number, type and size of Nozzles suitable for your installation.

THE MARTOCELLO CONDENSER WATER DISTRIBUTORS are now used as standard equipment by Progressive Refrigerating Engineers in solving their Manpower problem, because they require no attention and assure users of the lowest Condenser Operating Pressures and Minimum Power Cost.

It will pay you to consult us. WRITE or WIRE for further information.

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Serving the Ice Industry Since 1910 "There is no Substitute for MARTOCELLO QUALITY"

Engine Driven Refrigeration Compressors Units

No. 6478—Engine-driven compressors and compressor-condensing units in sizes from 15 to 35 tons are described in a new bulletin issued by the Ready-Power Co., 11231 Freud Ave., Detroit 14, Mich. The various units, designed for stationary, portable, or marine operation, feature unit construction, direct drive, unloaded starting, and automatic control. They are designed for use with "Freon-12" and the fuel used may be either gasoline, natural gas, or diesel oil.

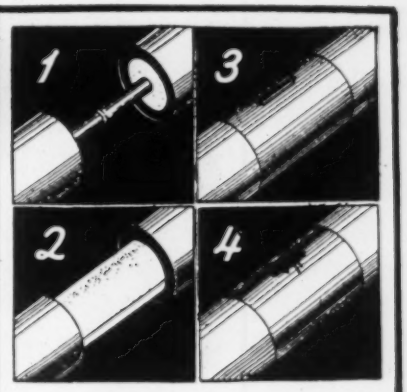
Feedwater Control

No. 6479—Bailey Meter Co., 1050 Ivanhoe Rd., Cleveland 10, Ohio, has released bulletin No. 105-B covering the company's three element, air-operated feedwater control system which is designed to avoid serious fluctuations in boiler water level. Steam flow-water elements are said to anticipate and correct for variations in the level even before they occur.

Germicidal Lamps

No. 6480—New Protection against Airborne Diseases is the title of a four page folder (No. 104) issued by the Lustra Corp. of America, 40 W. 25th St., New York 10, N. Y. Five new germicidal lamps are described and illustrated, including two "Protect-O-Ray" wall units for upper air disinfection, (one unit combining ultra violet radiation with fluorescent lighting), one portable unit for localized applications,

Positive Protection



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For all your underground and exposed piping jobs you'll like DURANT Pre-Sealed Insulated Pipe. It is waterproof . . . reduces installation costs to a minimum . . . eliminates electrolysis and corrosion . . . requires very little trenching and field work . . . avoids extra cost of waste and breakage . . . comes to you ready to install. In short, D.I.P. is the *perfect pipe* for this type of job. Investgate D.I.P.! Write for details today.

4 Simple Steps

1. Field joint ready for inspection. 2. Joint covered with standard pipe insulation. 3. Durant joint casing in place ready for asphalt. 4. Asphalt poured in slot making a perfect seal.

Ready to Install

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FOR STEAM HOT WATER REFRIGERATION

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The ORIGINAL Pre-sealed Insulated Pipe

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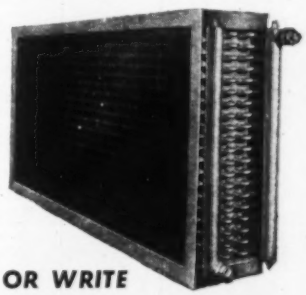
WHEN YOU HAVE A STANDARD or *SPECIAL* PROBLEM YOU ARE INVITED TO CONSULT WITH US

Modern Engineering, new materials, new Rempe methods have produced Pipe and Fin Coils for Refrigeration and Air Conditioning that last longer—are more efficient.

An example of Rempe leadership is the Rempe Air Conditioning Coil with copper tubes and headers (illustrated). Fins are aluminum. This coil is designed for use with cold water and is highly practicable wherever water is available in sufficient quantities below 62°F.

We Design and Manufacture

- Custom Built Air Conditioning Fin Coils
- Standard Fin Coils—for all needs—any material
- Custom built Evaporator Coils for blast freezing
- All types of Pipe Coils for heat transfer
- Overhead Blower Units for Low Temperature Cooling or Heating



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Find Out How This Water Treatment Formula Can Remove Costly Scale and Slime in Your Equipment

• If scale, slime, rust, algae are clogging up the lines of your cooling towers, condensers and hot water heating equipment look into the advantages of SOL-VET "08". SOL-VET service, highly recommended by leading engineers, offers you the facilities of one of the best equipped water laboratories in the United States. Thorough testing of your water can help determine the right SOL-VET service formula that will prevent clogging—booster equipment capacity, save needless shutdowns for overhauling. Write today for complete data on SOL-VET service with free analysis and recmomendations for your specific problems of removing scale and dirt.

Remember that if you find SOL-VET "08" is not exactly as represented—when used according to instructions, and full accurate report is given within 30 days from date of purchase—your money will be refunded in full.

End CLOGGING WORRIES on Cooling Towers and Condensing Units with . . .

SOL-VET "08"

GUARANTEED EFFECTIVE

If you find SOL-VET "08" not exactly as represented, when used according to instructions and full, accurate report is given within 30 days from date of purchase, your money will be refunded.

GUARANTEED HARMLESS

when used as directed, to all water conducting materials in water cooled equipment.

ANDERSON-STOLZ CORPORATION

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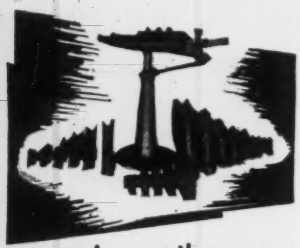
RADIANT HEAT PIPE BENDING
is EASY, FAST with
"American" MACHINES



Hand powered, the A-30 bends ½ to 2" standard pipe sizes at a radius of 5 to 1, up to 180°. Special radii can be supplied within these sizes.

Extra fast! — average bend made in 60 seconds! Versatile! — bends cold pipe, conduit and tube, copper and brass I.P.S. without crimping. Our world-wide customers include the United States Government, 9 foreign governments, and over 12,000 of the world's largest industrial plants.

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MAKE THAT HORSE POWER COUNT.
PUT THE AIR WHERE NEEDED . . .
WITH "COMMERCIAL" FAN HOUSINGS.

"Commercial" Fan Housings have been carefully engineered for the ventilating and unit heater industry, and the sizes now offered permit close to maximum efficiency of the unit on which they are installed.

The "Commercial" method of manufacture by cold forming eliminates all folds, cracks and welds—this method also increases the inherent strength and stiffness of the metal, reinforcing channels or braces are unnecessary—motor can be carried on the housing. The "Commercial" one piece Venturi type Fan Housing can be furnished in 12 different sizes and in three gauges.

Write for Prices.

THE COMMERCIAL SHEARING & STAMPING CO.
P. O. BOX 719 YOUNGSTOWN 1, OHIO

and two portable units for individual room sterilization and utilization in walkin refrigerators and food storage rooms.

Handbook on Glass, Paint and Metal Products

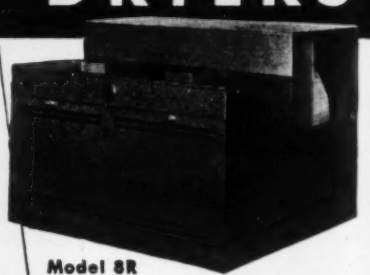
No. 6481—A new edition of the Pittsburgh Data Sheet Handbook is off the press and is being distributed by the Pittsburgh Plate Glass Co., 632 Duquesne Way, Pittsburgh, Pa. This pocket size, loose leaf folder contains individual sections on various products and is indexed for ready reference. Each copy is registered in the holders name so that additional sheets containing new information may be forwarded from time to time. It is said to condense all the factual information and the 13 sections provide physical data and installation procedures on various types of glass (including glass blocks, the "Twindow" insulating unit, and glass doors), paints, and store front metal.

Copies of the book are available to architects, draftsmen, and others in the building trades who make their requests, on company stationery, to Robert Wardrop, advertising manager.

High Pressure Valves

No. 6482—A description of "Pressure-Seal" valves manufactured by Walworth Co., 60 E. 42nd St., New York 17, N. Y. is featured in the Vol. 7, No. 2 issue of the company's house organ. Also described is the improved line of bronze globe and angle valves, available in sizes from ¼ to 3 in.

BRYANT SILICA-GEL
AIR-DRYERS



Designed for efficient CO-ORDINATED OPERATION with all types of AIR CONDITIONING EQUIPMENT

Model 8R

• Provides a continuous flow of dry air offering accurate control of humidity in air conditioning systems for

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AIR CONDITIONING ENGINEERS AND CONTRACTORS
FOR COMPLETE DATA, WRITE TO
BRYANT HEATER COMPANY
AIR DRYER DIVISION, 17825 ST. CLAIR AVE., CLEVELAND 10, OHIO
ONE OF THE DRESSER INDUSTRIES

Hot Process Water Softening

No. 6483—A new 68 page bulletin (Publication 3000) on hot process water softeners for the removal of hardness, corrosive gases, silica, and other scale-forming material from boiler feed and industrial process waters has been issued by Cochrane Corp., 17th St. and Allegheny Ave., Philadelphia 32, Pa. The book contains a nine page index of feedwater chemistry, in addition to heat balances, flow diagrams, and engineering tables and charts.

Induction Motors

No. 6484—Two recent bulletins on Series C induction motors have been published by the Reliance Electric and Engineering Co., 1076 Ivanhoe Rd., Cleveland 10, Ohio. Bulletin C-118 covers protected (open type) frame sizes 203 to 326, with horsepower ratings from ½ to 20 hp, 600 to 3600 rpm. Totally enclosed, fan-cooled Series C motors are described in bulletin No. C-125 which deals with squirrel cage frame sizes 224 to 326, for two and three phase a-c circuits.

Industrial Air Heater

No. 6485—Dravo Corp., 300 Penn Ave., Pittsburgh 22, Pa., has published a 12 page bulletin (No. 516) describing the company's "Counterflo" heater designed for industrial and commercial use. These warm air heating units are direct-fired, self-contained, and feature the use of stainless steel combustion chambers.

Get Extra Profits out of Radiant Heating by bending pipe on the job with Tal's Portable, Hydraulic Bender

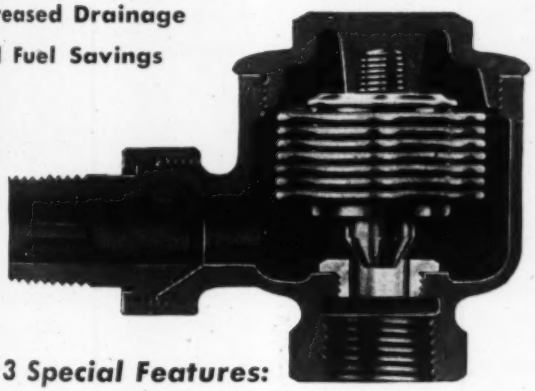
• Bending pipe on the job is making **more money** for those contractors alert enough to get behind radiant heating with the right equipment—a Tal portable pipe bender. This best engineered machine bends cold to any angle all wrought iron or steel pipe ⅜" to 3" in one single, fast moving operation. It reduces the need for welds by from 40% to 80% — speeds up installation work. Used now by leaders who know it repays its low cost many times a year. Write for bulletin

Tal's Prestal Bender, Inc.

Dept. HPA-2 Milwaukee 2, Wis.

NEW Nicholson traps feature FASTER ACTION

Increased Drainage and Fuel Savings



3 Special Features:

BALANCED VAPOR-PRESSURE PRINCIPLE

SPECIAL BELLOWS • LARGER VALVE ORIFICE

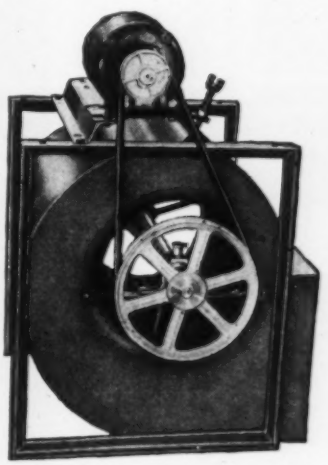
Installations of these new-type radiator traps show that their faster action saves in heat-up time and steam. 2 types, for 200 and 400 sq. ft. EDR, vapor and vacuum; pressure to 25 lbs. Competitively priced.

BULLETIN 744 describes new traps

W. H. NICHOLSON & CO. 198 OREGON STREET WILKES-BARRE, PA.

Valves ★ Traps ★ Steam Specialties

THE NEW UNIVERSAL TYPE "N" BLOWER



MASSACHUSETTS . .

By changing the position of the oil cup, the four popular discharges (lower horizontal, upper horizontal, down-blast and up-blast) can be obtained. Sizes 7 to 16½ inches wheel diameter.

WRITE FOR BULLETIN No. 110 CATALOG

MASSACHUSETTS BLOWER DIVISION

The BISHOP & BABCOCK Mfg. Co.

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Another Distinguished PUMP "by Aurora"

SIDE SUCTION CENTRIFUGAL

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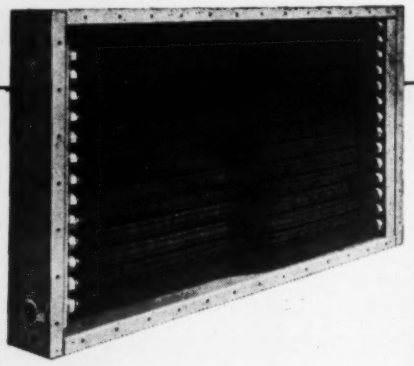

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Industrial Fire Hose

No. 6487—Hewitt Rubber Div., Hewitt-Robins, Inc., 240 Kensington Ave., Buffalo 5, N. Y., has released a six page illustrated folder covering its general line of industrial fire hose. Products described include "Monarch" single and double jacket fire hose and "Ajax" mill hose.

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No. 6488—The South Coles Levee (California) cycling plant is typical of a new development in the oil industry to increase the productivity of a field by injecting stripped gas back into the reservoir to maintain pressure and to keep the oil from disintegrating. The Fluor Corp., Ltd., 2500 S. Atlantic Blvd., Los Angeles 22, Calif., designer and constructor of the plant, has recently published a 32 page brochure describing and illustrating the installation. Besides many photographs there is a four color flow sheet which depicts the various

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stages in the process. In addition to applications of the company's pulsation dampeners, mufflers, and cooling towers, many piping installations are shown.

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No. 6489—Industrial instrument panelboards designed and built by Falstrom Co., Falstrom Ct., Passaic, N. J., are illustrated in a new bulletin. Photographs of installations are used to indicate the various types recommended.

Lathes and Accessories

No. 6490—The 13 in. lathes offered by South Bend Lathe Works, South Bend 22, Ind., are described and illustrated in color in the new catalog No. 13-F. Some of the features include a quick change gear box, a double wall apron equipped with a friction clutch to operate the longitudinal and cross feeds, and a fully enclosed motor.

Metal Clamping

No. 6491—Preformed and open end metal clamps, grooved hose fittings, tools, and accessories for clamping, splicing, tying, mending, and banding are described and illustrated in a new catalog published by the Punch-Lok Co., 321 N. Justine St., Chicago 7, Ill. A new "Clamp-Master" kit, offered for hose clamping on high or low pressures, for splicing cable, for tying conduit to pipe lines, and for many other maintenance applications, is also described.

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